

2014s-39

**Independent directors:
less informed, but better selected?**
New evidence from a two-way director-firm fixed effect model

*Sandra Cavaco, Patricia Crifo, Antoine Reberioux,
Gwenaël Roudaut*

Série Scientifique
Scientific Series

Montréal
Septembre 2014

© 2014 Sandra Cavaco, Patricia Crifo, Antoine Reberioux, Gwenaël Roudaut. Tous droits réservés. *All rights reserved.* Reproduction partielle permise avec citation du document source, incluant la notice ©.
Short sections may be quoted without explicit permission, if full credit, including © notice, is given to the source.



Centre interuniversitaire de recherche en analyse des organisations

CIRANO

Le CIRANO est un organisme sans but lucratif constitué en vertu de la Loi des compagnies du Québec. Le financement de son infrastructure et de ses activités de recherche provient des cotisations de ses organisations-membres, d'une subvention d'infrastructure du Ministère de l'Enseignement supérieur, de la Recherche, de la Science et de la Technologie, de même que des subventions et mandats obtenus par ses équipes de recherche.

CIRANO is a private non-profit organization incorporated under the Québec Companies Act. Its infrastructure and research activities are funded through fees paid by member organizations, an infrastructure grant from the Ministère de l'Enseignement supérieur, de la Recherche, de la Science et de la Technologie, and grants and research mandates obtained by its research teams.

Les partenaires du CIRANO

Partenaire majeur

Ministère de l'Enseignement supérieur, de la Recherche, de la Science et de la Technologie

Partenaires corporatifs

Autorité des marchés financiers
Banque de développement du Canada
Banque du Canada
Banque Laurentienne du Canada
Banque Nationale du Canada
Bell Canada
BMO Groupe financier
Caisse de dépôt et placement du Québec
Fédération des caisses Desjardins du Québec
Financière Sun Life, Québec
Gaz Métro
Hydro-Québec
Industrie Canada
Intact
Investissements PSP
Ministère des Finances et de l'Économie
Power Corporation du Canada
Rio Tinto Alcan
Ville de Montréal

Partenaires universitaires

École Polytechnique de Montréal
École de technologie supérieure (ÉTS)
HEC Montréal
Institut national de la recherche scientifique (INRS)
McGill University
Université Concordia
Université de Montréal
Université de Sherbrooke
Université du Québec
Université du Québec à Montréal
Université Laval

Le CIRANO collabore avec de nombreux centres et chaires de recherche universitaires dont on peut consulter la liste sur son site web.

Les cahiers de la série scientifique (CS) visent à rendre accessibles des résultats de recherche effectuée au CIRANO afin de susciter échanges et commentaires. Ces cahiers sont écrits dans le style des publications scientifiques. Les idées et les opinions émises sont sous l'unique responsabilité des auteurs et ne représentent pas nécessairement les positions du CIRANO ou de ses partenaires.

This paper presents research carried out at CIRANO and aims at encouraging discussion and comment. The observations and viewpoints expressed are the sole responsibility of the authors. They do not necessarily represent positions of CIRANO or its partners.

ISSN 2292-0838 (en ligne)

Partenaire financier

**Enseignement supérieur,
Recherche, Science
et Technologie**
Québec 

Independent directors: less informed, but better selected? *

New evidence from a two-way director-firm fixed effect model

*Sandra Cavaco[†], Patricia Crifo[‡], Antoine Reberioux[§], Gwenaël Roudaut^{**}*

Résumé/abstract

This paper develops a two-way director-firm fixed effect model to study the relationship between independent directors' individual heterogeneity and firm operating performance, using French data. This strategy allows considering and differentiating in a unified empirical framework mechanisms related to board functioning and to director selection. We first show that the independence status, netted out unobservable individual heterogeneity, is negatively related to performance. This result suggests that independent board members experience an informational gap compared to other affiliated members. However, we show that industry-specific expertise as well as informal connections inside the boardroom may help to bridge this gap. Finally, we provide evidence that independent directors have higher intrinsic ability as compared to affiliated board members, consistent with a reputation-based selection process.

Mots clés : independent director heterogeneity, information asymmetry, director selection, firm performance, two-way fixed effect model.

Codes JEL : G30, G34

* We thank Renée Adams, Andrea Bassanini, Stéphane Bonhomme, Vincent Bouvatier, François Kramarz, Son-Thierry Ly, Corinne Perraudin, Peter Pham, Ron Masulis, Peter Swan and the participants of the SASE 26th conference (Chicago) and the Brow Bag seminar, Department of Banking and Finance (UNSW) for helpful comments. We also thank Ethics&Boards (<http://www.ethicsandboards.com/>) for giving us free access to its database on directors. Support from Research program Investissements d'Avenir (ANR-11-IDEX-0003/Labex Ecodec/ANR-11-LABX-0047) and from the Chaire FDIR (Ecole Polytechnique & TSE IDEI) is gratefully acknowledged. Of course the usual disclaimer applies.

[†] LEMMA, University Panthéon-Assas.

[‡] Economix, University Paris West, Ecole Polytechnique and CIRANO.

[§] CREDDI/LEAD, University Antilles Guyane and Economix

^{**} Corresponding author: Ecole Polytechnique, Department of Economics, Route de Saclay 91128 Palaiseau Cedex, Mail: gwenael.roudaut@polytechnique.edu and AgroParisTech, visiting ESCP.

1. Introduction

Director heterogeneity and the way it relates to corporate performance are new promising research avenues in corporate governance, suggesting that simply focusing on independence might be misleading for researchers, regulators and shareholders. Recent studies on expertise and social network affiliation of independent board members have already started to lift the veil on this topic. They stress that not all independent directors are equivalent regarding the access to business information, with contrasted effects on firm performance. We contend however that there might be another important form of heterogeneity among directors, relating to individual intrinsic ability. It finds its source in selection processes that come to play in the appointment of independent board members. Accordingly, independent directors' efficiency to achieve their duties is mitigated by a large set of individual attributes (expertise, network affiliation and intrinsic ability) related to two distinct corporate governance mechanisms: board functioning (and in particular the extent of information sharing) and director selection. In this paper, we develop an original empirical approach, based on a two-way (director-firm) fixed effect regression model. It allows disentangling both mechanisms by identifying the relationships between the different sources of independent directors' heterogeneity (both observable and unobservable) and firm operating performance.

Debates and reforms on boards in listed companies have been, and still are, largely driven by director independence. It is, at least since the mid-80s, the main criteria to assess the adequacy of board composition, in the U.S.A, the U.K. and in continental Europe. The idea supporting independence is simple: if the primary duty of board members is to monitor corporate executives in the name of distant shareholders, then independence (*vis à vis* the management) should moderate collusion risk and reduce agency costs relative to affiliation through business or blockholder relationships (Jensen and Meckling, 1976). Accordingly, a majority of independent directors inside the boardroom has become conventional wisdom (Bhagat and Black, 1999). However, empirical evidence on the relationships between independence and firm performance (market-based or operating) presents mixed results, sometimes inconsistent with this conventional wisdom (Bhagat and Bolton, 2008 and 2013; Nguyen and Nielsen, 2010; Wintoki, Linck and Netter, 2012).

This should come at no surprise. As a number of articles have now stressed, the benefits of independence may come to a cost: corporate executives may be reluctant to share firm-specific information with directors perceived as 'watch dogs' (Raheja, 2005; Adams and Ferreira, 2007). Such information may help independent board members to assess the relevance of future projects and the achievement of past investments, and/or to evaluate CEO ability, thereby reducing managerial discretion. Hence, independent directors may be in a difficult position inside the boardroom, likely to suffer from an informational gap (Duchin, Matsusaka and Ozbas, 2010; Faleye, Hoitash and Hoitash, 2011). This in turn may limit the scope of their actions, preventing them from efficiently monitoring and also advising the CEO. This issue has been recently revived with two innovative arguments highlighting that the category of independent directors may actually be quite heterogeneous, regarding their

ability to bridge the informational gap, and ultimately to impact on board discrete tasks and corporate performance. The first argument insists on expertise, the second on informal networks' affiliation. A number of studies have examined the way financial expertise (DeFond, Hann and Hu, 2005; Burak Güner, Malmendier and Tate, 2008; Minton, Taillard and Williamson, 2011; Reeb and Zhao, 2013) and industry-specific expertise (Faleye, Hoitash and Hoitash, 2013; Wang, Xie and Zhu, 2013; Dass, Kini, Nanda, Onal and Wang, 2014) may help countervail independent directors' informational gap. In parallel, a second research stream has paid attention to the existence of social networks in the boardroom: some independent directors may share informal (social, professional and educational) connections with other board members or top executives, with some impact on the way they play their monitoring and advisory roles (Hwang and Kim, 2009; Nguyen, 2012; Kramarz and Thesmar, 2013).

To date however, little researches have examined what might be another key issue regarding director heterogeneity: the difference among individuals in terms of intrinsic ability. A proficient director, beside her particular expertise and her network (board-related abilities), should have general competence fostering her ability to set 'the tone at the top'. She must be able to synthesize disparate and complex information. She also should have a mind-set of critical thinking in face of corporate executives, as well as the ability to properly intervene during important meetings and to convince her peers. In this article, we contend that this sort of heterogeneity may play an important role in explaining the global value or impact of independence. Central to this argument is the possible existence of a sorting or selection process, by which independent directors would have intrinsic ability that differ from other, non-independent (affiliated or insiders) board members. Two opposite arguments come in mind, that ultimately relate to the relative bargaining power of CEOs in the (directors') selection process (Hermalin and Weisbach, 1998). The first argument rests on the idea that CEOs may use their influence over directors' appointment process to pick 'lapdogs' (that is 'low ability' individuals) that won't interfere with their managerial power (Cohen, Frazzini and Malloy, 2012). In contrast with this adverse selection process, the second argument considers that CEOs may be forced to accept the appointment of 'high ability' individuals in the interest of the shareholders, so as to avoid negative market reactions (and ensuing falls in firm value). This reputation-based selection process supposes that independent directors may significantly differ in terms of external reputation (Masulis and Mobbs, 2011; White, Woidtke, Black and Schweitzer, 2013).

The previous discussion suggests that from a theoretical and empirical point of view, the value of independence depends on two distinct mechanisms and related types of heterogeneity. The first mechanism concerns board functioning (less collusion *versus* less information sharing) and is associated with the heterogeneity among independent directors in terms of board-related abilities (expertise and informal connection). The second mechanism concerns the selection process of independent directors and is related with their relative intrinsic ability as compared to other, non-independent directors (adverse selection *versus* reputation-based selection). Our study seeks to empirically identify and distinguish, when

considering the impact of independence on operating performance, both mechanisms. To do so, we take advantage of an original database of French listed companies, providing information at the individual level. This design makes it possible to estimate individual board-related attributes and individual fixed effects in firm performance equation – echoing the approach developed by Bertrand and Schoar (2003) for top executives. More precisely, our empirical strategy follows the AKM methodology (Abowd, Kramarz and Margolis, 1999) that makes use of (longitudinal) linked employer-employee data to disentangle firm effects and person effects in wage formation. This empirical strategy, based on a two-way director-firm fixed effect regression model, has three advantages.

First, controlling for individual fixed effects enables to alleviate individual (time and firm invariant) heterogeneity concerns when considering the relationship between performance on the one hand and independence and board-related attributes on the other hand. We are thus able to directly observe the effects of the independence status¹ and the effects of heterogeneity among independent directors, irrespective of individual intrinsic ability. Our estimation reports a negative significant conditional correlation between independence position and performance, suggesting that in the French case the informational gap outweighs the benefits of more intense monitoring. We also find that industry expertise (proxied by past professional experiences) as well as informal connections with other board members may help to bridge the informational gap, with a positive relation with performance. In contrast, financial expertise when interacted with independence is not significantly associated with higher performance.

Second, estimating individual fixed effect allows a direct test of the difference in intrinsic ability distribution between independent and non-independent directors. Controlling for individual observable attributes and firm fixed effects, a quantile regression shows that there is a positive conditional correlation between individual ability and independence within firms, and that this correlation is stronger for the lowest deciles of individual effects. This evidence is consistent with a reputation-based selection, whereby the most talented individuals are appointed as independent directors. In other words, the independent directors' selection seems to be driven more by the interest of shareholders than by the interest of top management.

Third, from a methodological perspective, whereas the classical methods used in the previous papers deal with the issue of dynamic endogeneity (natural experiments with difference in difference analysis, instrumental variables, GMM), they mostly fail to properly take into account individual heterogeneity (omitted variables like individual talent) and complex corporate governance mechanisms. Our framework enables to control for a large set of omitted variables, broader than previous analysis on board composition and firm performance, thanks to the estimation of year, firm and director fixed effects. Thanks to the connectedness

¹ Here, we use the term status to designate the “fact to be an independent directors” inside the boardroom relative to be an affiliated directors and not the individual who hold the directorship.

property of the AKM framework, it also disentangles board-related attributes (board functioning) and director fixed effects (director selection) – the confusion of which may have jeopardized some significant effects of independence in the previous studies. To our knowledge, it is the first time that the two levels of analysis are emphasized in the same performance equation. Moreover, *ex post* tests confirm that dynamic endogeneity is a small concern in our analysis: firms do not hire independent directors, whatever their intrinsic ability, regarding their past performances (good or bad). Furthermore, the exogenous assumptions assumed by the AKM framework can be fairly supported by our data: the matched effect between directors and firms is very small and does not seem to drive our results. All these tests enable us to be pretty confident in our estimation and to validate the AKM framework as an innovative answer to our research question.

Our results are important insofar as they help to better understand the contradictory effects, both the dark and bright sides, of director independence. They show that in corporate governance matter, external requirements may have some unintended effects. In the French case, it is hard to observe beneficial net effects of independence on operating performance. On one hand, the independence fad has affected board composition and functioning, probably reducing the extent of information sharing inside the boardroom. But on the other hand, it goes with a more proficient selection process, whereby the appointment of independent members obeys to efficiency considerations.

We use an original database on 108 French listed firms (among the SBF120, i.e. the 120 largest listed companies by market capitalization on Euronext Paris, excluding financial companies), mixing firm-level information (board composition, financial data) and individual information (education and careers in particular) for 1,325 distinct directors, over the 2006-2011 period. This sample is interesting for several reasons. France is a major western economy, with a highly liquid stock market (Euronext Paris). To some extent, the French corporate governance model presents its own characteristics, with a relatively high level of ownership concentration and the possibility for companies to choose between a one-tier (US-UK style) and a two-tier (German style) board structure. It has however some important similarities with Anglo-Saxon countries, following a process of convergence over the last 20 years (Martynova and Renneboog, 2010). There has been a dramatic growth in stock market capitalization, fuelled by the increasing presence of investment funds, both resident and non-resident. This increase in the power of institutional investors has been accompanied by important changes in securities law and, to a lesser extent, in corporate law (Lele and Siems, 2007). These changes have strongly enhanced minority shareholder protection, while separation between CEO and chairman positions has gained in importance. Unsurprisingly in such an environment, independence has become the conventional wisdom, a decade after the USA or the UK. Nevertheless, as the “comply or explain” principle applies in the French corporate governance code, firms present a more diversified board composition than US companies, especially regarding independence. The French corporate governance context is therefore an interesting and complementary subject for the literature. Furthermore, using a sample of large French companies provides a unique framework for our empirical analysis.

Our identification strategy requires sufficient director ‘mobility’ among sampled firms. Basically, we need to have some individuals being appointed in multiple firms in our sample to accurately differentiate firm and individual fixed effects. Crucially, multiple directorships (*cumul des mandats*) are a prominent feature of the French corporate system, at least when considering large companies (see e.g. Fanto, 1998). In fact, a quarter of our directors sits in more than one board of the SBF120 over our sample period. Enlarging our sample to smaller companies, where isolated boards dominated by family and corporate insiders are the norm, would not have increased the precision of our estimations.

Our focus on director heterogeneity as mediating the relationship between board independence and corporate performance allows contributing to two different strands of the literature: the informational gap of independent directors and the role of individual talent in business conduct.

First, we complement the debate on the informational gap and the factors that may mitigate it. We are able to assess how independence, expertise and network affiliation relate to performance netted out unobservable individual heterogeneity concerns. It is important insofar as they are good reasons to believe (i) that the independence status is correlated with personal ability whenever selection occurs in the appointment process and (ii) that having industry or financial expertise or belonging to a high-ranking civil servant network is correlated with intrinsic personal ability. We are thus able to observe more precisely than other empirical studies the relationships between these factors and performance. To do so, we rely on a unique database, with information both on professional career and education, and on an original empirical approach based on the AKM statistical framework. It allows distinguishing firm- and director-unobservable time-invariant effects and observable time-variant effects in performance equations.

Second, since Bertrand and Schoar (2003), there has been an increasing interest in the way managerial heterogeneity may impact on governance structure, firm decision and performance, as well as on executive compensation (see e.g. Graham, Li and Qiu, 2012; Coles and Li, 2013, Arena and Braga-Alves, 2013; Fee, Hadlock and Pierce, 2013). We extend this analysis to (individual) directors and connect our results with board members’ selection. While the estimation of director fixed effects has been used as a robustness check for a small subsample of agents by a couple of papers (see in particular Nguyen and Nielsen, 2010 and Masulis and Mobbs, 2014), we are the first to our knowledge to estimate director fixed effects for a comprehensive sample of firms and individuals.² We are then able to compare the distribution of individual talents across different groups of directors.

² As a matter of fact an (unpublished) study by Richardson, Tuna and Wysocki (2003) investigates in detail director fixed effects. There are, however, two key differences with our approach. First, they are not interested in firm performance, but in a range of firm policies (regarding governance, financial, disclosure and strategic policies). Second, they do not use the AKM method: they limit their investigation to directors who sit on at least

Finally, this approach is in line with the new research stream that focuses on the incentives, motivations and abilities of each board members (Masulis and Mobbs, 2011, 2014) rather than on the board (or subgroups of directors) as a representative, monistic, agent. At a broader extent, our empirical strategy allows to consider in a unified framework what can be considered as two of the most important aspects in the economics of independent directors: independent board members' selection and independent board members' position and action inside the boardroom. By so doing, we follow Adams, Hermalin and Weisbach. (2010), who conclude their survey on the role of board of directors in corporate governance in the following manner: "*Boards of directors are difficult institutions to study. The two questions most asked about boards concern what determines their makeup, and what determines their actions*" and "*Ultimately, many of the strongest empirical regularities that have been found can best be interpreted as statements about both the director-selection process and their direct effect on board actions*" (p.96-97).

The remainder of the paper is organized as follows. Section 2 derives the literature and hypotheses of our study. Section 3 discusses our identification strategy. Section 4 presents the data and section 5 details our results. Section 6 examines endogeneity issues and section 7 concludes.

2. Backgrounds and hypotheses

This section gives an overview of the literature on director independence³ and develops a series of hypotheses regarding the empirical relationship between board independence and firm operating performance. We first focus on board functioning and board-related attributes of independent directors, by considering the informational gap argument, and then tackle the (somewhat neglected) issue of intrinsic ability heterogeneity stemming from director selection.

2.1. Board functioning: the informational gap

Monitoring corporate executives is often considered the *raison d'être* for board of directors, conceived as an agency costs reducing-mechanism (Jensen and Meckling, 1976). The main benefit expected from board independence is then the limitation of collusion between directors and corporate officers (Hermalin and Weisbach, 1998). Independence proponents – whether shareholder activists, regulators, lawmakers or governance scholars – all refer to this argument. However, seminal papers by Raheja (2005) and Adams and Ferreira (2007) stress the fact that corporate executives may be reluctant to share firm-specific information with

two different boards at the same time, introducing a questionable selection bias. As it will be clear in the empirical strategy section, we are able to estimate individual fixed effects for multi-boards *and* single-board individuals, as long as they belong to a so called 'connected group' (which covers 96% of the directors present in our comprehensive sample of large French companies).

³ For a comprehensive review on board composition and functioning, see Adams, Hermalin and Weisbach, (2010).

outside, independent directors perceived as ‘watch dogs’. This informational gap may of course impede the ability of independent directors to effectively monitor, but also to advise, corporate executives. If true, independence may have detrimental effect on firm performance, especially when the firm operates in complex environments (Duchin, Matsusaka and Ozbas, 2010; Faleye, Hoitash, and Hoitash, 2011). Ultimately, whether being independent brings benefits to the firm is an empirical question. We therefore state the following first hypothesis:

Hypothesis 1 (H1): if the benefits of independence (reduced agency costs) outweigh the costs due to the informational gap, we expect a positive conditional correlation between firm performance and the independence status.

Three elements may reduce the informational deficit of independent directors, thereby enhancing their effectiveness: industry expertise, financial expertise and social connections at the board level.

The fact that industry expertise may strengthen board effectiveness has received empirical support in the literature. For instance Dass, Kini, Nanda, Onal and Wang (2014) report a positive conditional correlation between firm value and the share of “directors in related industries” (i.e. that are officers and/or directors of companies in the upstream/downstream industries of the firm). Yet it has long been recognized that the criteria used in virtually all jurisdictions to define independence do not favor such industry expertise (Baysinger and Hoskisson, 1990; Rosenstein and Wyatt, 1997). This does not mean, however, that all independent directors are amateurish regarding the firm business model. And crucially, a couple of recent papers produce evidence consistent with the argument that such an expertise is specifically important regarding independent board members’ effectiveness. For instance, Faleye, Hoitash and Hoitash (2013) observe that the share of industry experts among independent directors is positively associated with firm value. Similarly, Wang, Xie, Zhu (2013) find that the percentage of independent expert directors on the audit committee is significantly related with a lower likelihood of intentional financial misreporting⁴. In light of these results, we formulate our second empirical hypothesis:

*Hypothesis 2 (H2): If industry expertise helps reduce the independent directors’ informational gap, we expect a positive conditional correlation between firm performance and the interacted term independent*industry specific expert.*

While industry expertise is recognized as an important attribute for independent directors, another type of expertise has also been a subject of significant interest from regulators and

⁴ Both Faleye, Hoitash and Hoitash. (2013) and Wang, Xie and Zhu (2013) define a board member as an industry expert if the two-digit SIC code of the firm where she sits is the same than the two-digit SIC code of at least one firm in her employment experience. Note that Wang, Xie and Zhu (2013) only consider director or executive experience.

scholars: financial expertise. The board, in the U.S. as well as in Europe, should certify financial statements and other public information. In addition, it supervises reporting and disclosure procedures, by recommending the external auditor to shareholders and by interfacing with external auditors, internal auditors and management. Following a path-breaking provision of the Sarbanes Oxley Act (SOX)⁵, most jurisdictions now require financial literacy at the board level, especially for audit committee members⁶. A substantial body of empirical research has sought to assess the value brought by financial literacy (e.g. DeFond, Hann and Hu, 2005; Burak Güner, Malmendier and Tate, 2008; Minton, Taillard and Williamson, 2011; Reeb and Zhao, 2013): by and large, this body confirms that financial expertise may enhance board effectiveness. In our framework, financial literacy should increase independent director ability to cope with the information communicated by corporate insiders. This leads us to state our third hypothesis:

*Hypothesis 3 (H3): If financial expertise helps overcome the independent directors' informational gap, we expect a positive conditional correlation between firm performance and the interacted term independent*financial expert.*

Beside expertise (industry or financial), another factor may impact the effectiveness of independent directors: the extent of informal connections with corporate executives or other board members. Considering connections with other directors, the expected effect is *a priori* straightforward: for a given director, sharing social networks with at least some other board members should increase her power and effectiveness. Informal connections ease information circulation among network members (Cohen, Frazzini and Malloy, 2008, Coles, Daniel and Naveen, 2012), and probably increase the strength of conviction for a person belonging to the network. We therefore expect social connections to narrow independent director informational gap: as such, they will be associated with greater performance. Regarding informal connections with the CEO, the net effect is more ambiguous. On one side, informal connections may limit the willingness of independent directors to supervise and sanction CEOs. Using French data Kramarz and Thesmar (2013) bring evidence consistent with this hypothesis (see also Hwang and Kim, 2009; Nguyen, 2012; Fracassi and Tate, 2012; Coles, Daniel and Naveen, 2014): they show that social networks (defined through education and career) decrease the probability of CEO dismissal when the company underperforms, and increase CEO compensation. On the other side, being connected to the CEO may enhance the ability of an independent director to extract firm-specific information: informal networks foster a climate of mutual trust that should favor information sharing, thereby reducing the informational gap (Westphal, 1999; Cohen, Frazzini and Malloy, 2010; Schmidt, 2014). We thus formulate the following two hypotheses:

⁵ SOX requires that each member of the audit committee is financial literate, and that one of this member is a financial expert (for more details, see e.g. Linck, Netter and Yang, 2009).

⁶ For instance, the 8th EU Directive on company law (2006) requires listed companies to have an audit committee, with at least one member having financial literacy.

*Hypothesis 4 (H4): Sharing informal network with other board members increases effectiveness. We expect a positive conditional correlation between performance and the interacted term independent*board connection.*

*Hypothesis 5 (H5): If the benefits of informal connection with CEO (greater access to information) outweigh its costs (higher agency costs), we expect a positive conditional correlation between performance and the interacted term independent*CEO connection.*

2.2. Directors' selection and heterogeneity

The previous discussion and hypotheses have focused on board functioning (or information sharing inside the boardroom). We contend however that a full understanding of the economics of independence also necessitates investigating (independent) directors' appointment and selection. By selection, we consider any process that contributes to create heterogeneity in terms of talent (or ability) across groups (i.e. here independent *versus* affiliated directors). To be clear, let us consider as a starting point that there are two groups of *potential* non-insider directors: affiliated and independent⁷. We may assume that the distribution of talents is strictly similar across these two groups. However, we only observe directors who have been *effectively* appointed at the board. There will be selection if the ability distribution among independent directors is significantly different from the distribution among affiliated directors.

To understand this selection process, it is important to note that affiliated directors are probably not selected on the basis of their inherent ability, but for some specific attributes that are orthogonal with it. Indeed, affiliated directorship is (most of the time) based on a representativeness principle (for instance blockholder representative or worker representative). Accordingly, affiliated directors would be randomly chosen on the (non-observable) distribution of potential affiliated board members: the distribution of talents for this group should reflect the whole ability spectra. We contend that the situation is different for independent directors, as ability (probably correlated with a set of observable attributes) is likely to be the primary criterion of selection. Basically, we consider two mutually exclusive selection processes that will have distinctive effects on the distribution of talents: a first one driven by CEOs' opportunistic behavior (adverse selection) and a second one driven by the interest of the shareholders (reputation-based selection). Understanding these processes requires delving into director appointment and removal mechanisms and dynamics.

⁷ Insider directors may present a selection bias due to the fact that they usually hold the most powerful positions in the firm (CEO, CFO) and should be hired as the most talented directors on a competitive executive labor market.

Shareholders are empowered with the rights to elect and remove directors. However, a number of authors have argued that shareholders direct influence over board makeup is actually limited, at least in the U.S. (see e.g. Mace, 1986; Rosenstein and Wyatt, 1990; Warther, 1998). Regarding removal, staggered boards offer to incumbent directors a significant (and rather common) protection. Regarding appointment, the influence of top executives on the slate of nominees is arguably dramatic (Bebchuk and Fried, 2004). In addition, the vast majority of elections are uncontested. Arguably, French corporate law gives shareholders more authority over board composition (Armour, Deakin, Lele and Siems, 2009), particularly considering removal. Shareholders in French listed companies may revoke directors *ad nutum*, at any general assembly meeting, without notice and without reason (Code de commerce, article 225-18). Nevertheless, (minority) shareholders' *de facto* power is quite limited: *ad nutum* revocation is extremely rare, and the slate of nominees is still influenced by top executives. In light of these elements, the involvement of CEOs in directors' selection is hardly negligible.

The crucial question is then the following: what might be the consequences of managerial involvement in director selection regarding board composition, and more specifically regarding the ability of independent directors?

A first possibility is to consider that managerial direct influence is strong enough to allow CEOs to make up board composition according to their own interests or preferences (Hermalin and Weisbach, 1998). There is empirical evidence supporting this argument. In the U.S. case, Shivdasani and Yermack (1999) observe that when the CEO serves on the nominating committee (or when no such committee exists), companies appoint fewer independent directors. Cohen, Frazzini and Malloy (2012) provide evidence that firms tend to select so-called "cheerleaders" as independent directors, that is individuals who are overly sympathetic to top management. In the French case, Kramarz and Thesmar (2013) show that the probability for a director to be appointed in firm j increases when she belongs to the same network as firm's CEO (defined in terms of education or career). Accordingly, just like managerial power may be used to extract rent in the form of soaring compensation (Bebchuk and Fried, 2004), CEOs may use their power to reduce the monitoring effectiveness of the board. Consistent with this idea, Carcello, Hermanson and Ye (2011) show that firms that experiment the most severe restatements are those where the CEO is involved in the selection process. As board monitoring effectiveness mainly depends on independent directors, CEOs may use their influence to avoid the appointment of 'high ability' individuals as independent. In contrast, no effort should be made to screen (and reject) low ability individuals.⁸ This

⁸ Lehman Brothers constitutes a conspicuous example (Minow, 2008): the investment bank had a super majority board (with more than 80% of independent) comprising one theater producer, a retired US Navy admiral, the former CEO of Sotheby and of the National Trust for Historic Preservation and, up until 2006, a former Hollywood Actress, Dina Merrill. Arguably, these independent directors had all been specifically selected (nominated or reappointed) for their lack of perspicacity (at least regarding corporate governance and securitization), by the CEO in position since 1994 until 2008.

argument is to some extent a simple extension to the selection process of the Adams and Ferreira (2007)'s argument: while they portray CEOs as voluntarily restricting the share of firm-specific information to limit the monitoring effectiveness of independent directors, it is plausible that CEOs use their influence to avoid the appointment of highly talented persons as independent board members. We end up with the following prediction about the relationship between director status and individual ability:

Hypothesis 6 (H6): if independent directors are adversely selected by CEOs, we expect to observe more frequently the appointment of low ability individuals as independent director, as compared to affiliated director.

The previous story portrays board makeup as being largely shaped by CEOs willingness to reap the benefits of deficient monitoring. From this perspective, CEOs' involvement in director selection should immediately convert into sound influence over board composition despite shareholders' rights. Actually, this conclusion is not straightforward. First, the increasing prevalence of nominating committees at the board level may *de facto* reduce the influence of CEOs on the appointment process. Nevertheless, only few of these committees are fully independent (less than 20% for the SBF120). Second, and more importantly, in listed companies, shareholders not only hold the right to vote their shares; they also have the opportunity to sell and buy stocks, therefore impacting the firm value. This may induce management and board to best serve shareholders' interests when selecting directors, in order to minimize the threat of hostile takeover (and the threat of being fired), to secure the value of stock-based compensation plans and to benefit from a positive signal towards the shareholders.

This mechanism may have important consequence regarding board composition, if one condition holds: namely if investors are able to observe, determine or infer director ability through different signs (such as board meeting attendance, behavior in other companies, etc.), before their appointment or renewal. In this case, reputation concerns may become an important driver of director appointment: investors will globally approve or reprove the selection of a particular individual, inducing positive or negative movements in the firm value. A couple of studies yield evidence of such reputation effects that may severely limit managerial discretion regarding board members' selection. In particular, Fich (2005) shows that the cumulative abnormal return following the appointment of a director who is CEO of another firm j increases with the (industry-adjusted) ROA of firm j . Fich and Shivdasani (2007) do not directly examine stock-market reaction, but bring indirect evidence of reputation effects: they report that directors of firms facing shareholder class-action lawsuits alleging financial fraud lose outside board seats. Another example is provided by Cai, Garner and Walkling (2009), who show that directors who attend less than 75% of board meetings receive 14% fewer votes in general assembly. More recent evidence of reputational effects is provided by Masulis and Mobbs (2011) for inside directors, by Ertimur, Ferri and Maber (2012) for outside directors in firms involved in the 2006-2007 option backdating scandal,

and by Masulis and Mobbs (2014) for independent directors (showing that these latter allocate their effort so that the best outcomes are obtained in the most visible boards).

The main argument so far is that shareholders may have a significant, albeit limited, influence over board composition (through the stock exchange), despite managerial involvement: reputation effects may force managers to select directors that please (minority) shareholders. What might be the effect regarding ability distribution among independent directors? CEOs will be willing to avoid low ability individuals and look for talented outside directors who will allow to comply with regulatory requirements on one hand *and* to please investors' expectations on the other hand. The selection process of independent directors will then be such that low ability persons should have a lower probability to enter the boardroom. In light of this argument, we state the following final hypothesis:

Hypothesis 7 (H7): if reputation effects are effective, we expect to observe more frequently the appointment of high ability individuals as independent director, as compared to affiliated director.

Importantly, H6 and H7 are mutually exclusive: if managerial involvement in director selection is hard to neglect – at least in the U.S. or in France – the consequences of this power regarding independent directors' relative ability can only be settled through an empirical examination. Clearly, the two selection mechanisms will have specific observable effects regarding individual ability distribution among independent directors relative to affiliated directors (taken as reference). The first process (“adverse selection”) implies a right-truncation for the distribution of talents among independent board members. In contrast, the second process (“reputation-based selection”) induces a left-truncation. Figure 1 plots ability distribution for independent directors under these two different processes relative to affiliated directors' distribution (so called “no selection”).

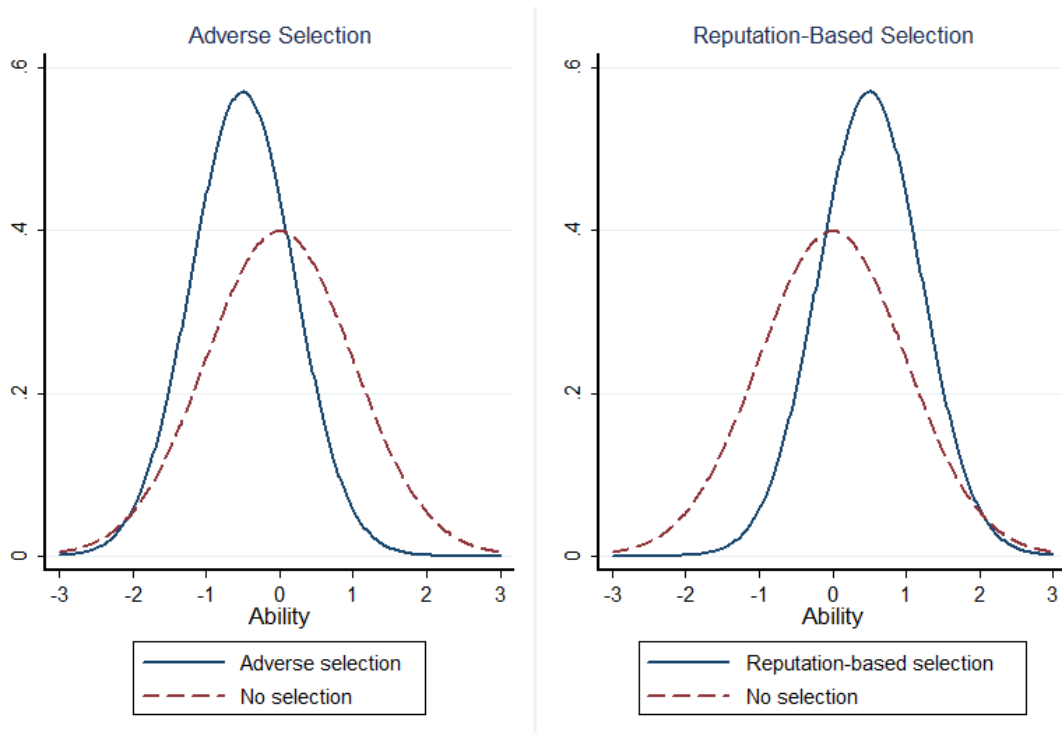


Figure 1: Theoretical independent directors' ability distribution under different selection processes

We are finally led to rephrase our hypothesis as follows:

H6': if independent directors are adversely selected by CEOs, we expect to observe a truncation on the right for the distribution of individual ability among independent directors (relative to the distribution among affiliated directors).

H7': if reputation effects are effective, we expect to observe a truncation on the left for the distribution of individual ability among independent directors (relative to the distribution among affiliated directors).

3. Identification strategy

To test our hypotheses, we need to estimate both the effect of different statuses and board-related attributes (e.g. independent, insider, industry expert, etc.) on performance and the (unobservable) intrinsic ability of different individuals. We therefore disaggregate firm-level performance equation at the individual level: each observation is a triplet (director-firm-year). This approach, while uncommon, extends the analysis conducted by Bertrand and Schoar (2003) that empirically imputes part of firm performance to top-executives' (CEOs but also Chief Financial Officers and other top managers) individual characteristics. For our part, we look for director effects rather than managerial effects. While director effects have already been examined in relation to corporate policies and governance (see e.g. Richardson, Tuna and Wysocki, 2003; Arena and Braga-Alves, 2013), it is the first time, to our knowledge, that the analysis is extended to firm performance. Our baseline model is the following:

$$Y_{i,j,t} = \rho + \alpha_1 \text{Independent}_{i,j,t} + \alpha_2 \text{Insider}_{i,j,t} + \beta X_{j,t} + \gamma Z_{j,t} + \mu_i + \delta_j + \theta_t + \varepsilon_{i,j,t} \quad (1)$$

where $Y_{i,j,t}$ is the performance at time t of the firm j where director i holds a seat, μ_i is a personal identifier (director fixed effect), δ_j is a firm identifier (firm fixed effect) and θ_t is a time dummy. Director fixed effects capture both time- and firm-invariant observable attributes (gender, nationality) and (unobservable) intrinsic ability. $\text{Independent}_{i,j,t}$ (resp. $\text{Insider}_{i,j,t}$) is a dummy that values 1 if the director i is independent (resp. insider) in firm j at time t . $X_{j,t}$ is a vector of board structure variables (including among others board size, proportion of women, but also the proportions of independent directors and of insiders) and $Z_{j,t}$ a vector of firm characteristics (number of employees, financial leverage, etc.) in firm j at time t . The last component is the statistical residual $\varepsilon_{i,j,t}$.

To estimate model (1), we rely on the approach first proposed by Abowd, Kramarz and Margolis (1999) in labor economics (AKM), and further developed by Abowd, Creedy and Kramarz (2002). This method provides a statistical framework for decomposing wage rates into components due to individual heterogeneity (observable and unobservable) and firm heterogeneity (observable and unobservable), using matched (longitudinal) employer-employee data and worker mobility across firms. In the AKM set-up, individual and firm fixed effects are separately identifiable for connected group of workers and firms, through standard methods of covariance analysis. A connected group contains all the individuals who have ever worked for any of the firms which are linked by at least one individual over the period.

We extend this approach to a model of director-firm outcomes, using individual (director) multiple seats and mobility across firms as a source of identification of individual effects and firm effects. Our baseline model (1) is correctly estimated if two conditions hold. First, we need to have sufficient individual mobility, so that the group of connected directors/firms is large enough to consistently estimate firm fixed effects and person fixed effects. Second, the

statistical residual should of course be orthogonal to all variables in the model. In particular, we need to have $E[\delta_j; \varepsilon_{i,j,t}] = 0 \forall j$ and $E[\mu_i; \varepsilon_{i,j,t}] = 0 \forall i$. These orthogonality conditions suppose that the assignment of directors in the different companies is strictly exogenous. In section 6, we perform several tests in order to valid this ‘exogeneous mobility’ assumption.

Three further considerations are needed. First, and by definition, there is a direct relationship between our dummy $Independent_{i,j,t}$ and the proportion of independent directors in firm j at date t ($\% Independent_{i,j,t}$) included in the $X_{j,t}$ vector. To deal with it, we simply re-compute $\% Independent_{i,j,t}$ while excluding individual i . We apply the same treatment for the share of insiders, and (when they are introduced in the following model) for the shares of industry-experts and of industry-expert independent directors. Second, as we have multiple observations per firm-year, we compute standard errors which are robust to this two-dimensions within-cluster correlation⁹. Third, individual fixed effects are normalized, summing to zero. This avoids having our estimation driven by the (random) choice of a given person for reference and makes interpretation easier¹⁰.

It is clear from equation (1) that the estimation of coefficients on independence (α_1) is not possible for directors that never change status either across firms or in a given company. Suppose we have an individual i that sits in two different boards during our sample period, but always as an independent director. The independent status effect cannot then be separated from her individual fixed effect. Status effects are identified using two sources of variation: variation in status for a director having multiple holdings in different firms (inter-firm variation) and variation in status over successive years for a director in a given firm (intra-firm variation)¹¹. Potential selection biases are further discussed. Of course, this coefficient is correctly estimated if *Independent* is exogenous regarding firm performance: we discuss this issue in section 6.

⁹ As discussed by Petersen (2009), multi-dimensional clustering is a critical issue in corporate finance research. Due to the structure of our dependent variable (annual performance of the company in which each director sits), the correlation within firm-year cluster is the most important bias we have to take into account in the estimation of standard errors. Introducing the director dimension in the cluster would correct the standard errors for any correlation within director observations. Nevertheless, the two-ways firm-year and director cluster does not significantly change our result (results available upon request). Introducing year or firm dimension would be redundant with the firm-year cluster chosen in the analysis. The other potential correlations are taken into account by the introduction of director, firm and year fixed effects.

¹⁰ The user-written do file `reg2hdfe` (Guimaraes and Portugal, 2010) allows this normalization, while having clustered standard errors.

¹¹ While primary surprising, the case of people changing status in the same firm is possible. People who switch from independent to non-independent belong to the following cases: an independent director who passes the 12-year threshold for seniority, someone who becomes involved in a business relationship with the company, and finally someone who becomes a corporate executive or a worker. Alternatively, the switch from non-independent to independent encompasses the following: a director classified as gray because she was a corporate executive within the previous five years but for whom the criterion no longer applies; and a gray director that terminates a business relationship with company. In our sample period, only 2% of directors change status within the same firm; as a consequence, α_1 is almost exclusively identified on inter-firm variation.

In extended versions of model 1, we consider the effects of other possible board-related individual attributes, namely industry expertise, financial expertise, gender, relative CEO-director power (as proxied by board structure), and the affiliation to various informal networks. For instance, if we want to measure the correlation between performance on one side, and independence and industry expertise on the other side, we estimate the following model:

$$Y_{i,j,t} = \rho + \alpha_1 \text{Independent}_{i,j,t} + \alpha_2 \text{Insider}_{i,j,t} + \alpha_3 \text{Industry Expert}_{i,j,t} + \alpha_4 \text{Independent}_{i,j,t} * \text{Industry Expert}_{i,j,t} + \beta X_{j,t} + \gamma Z_{j,t} + \mu_i + \delta_j + \theta_t + \varepsilon_{i,j,t} \quad (1')$$

While the validity of H1 to H5 relies on the estimation of α parameters, testing H6 and H7 requires comparing the ability distribution across two groups, independent and affiliated directors. In our framework, director ability is estimated using director fixed effect. We should however be cautious that our results are not driven by inaccurately estimated person fixed effects (among our connected group). As a consequence, we exclude from our sample, before running any regressions, individuals who appear only once over our sample period (i.e. only one year in one firm). Indeed, for these individuals, our empirical model is unable to distinguish the person fixed effect and the error term. These individuals are mainly directors who finish their directorships at the beginning of our period (2006, 39%) or that are newly appointed when our period ends (2011, 42%). For this reason, we contend that the probability to induce a selection-bias in our estimation is a minor concern. A second problem arises when considering directors appointed in a single firm (i.e. non movers), arriving and leaving at the same dates. Contrary to a standard AKM model (where wage rate is different for each individual), the statistical structure of our dependent variable does not offer in this case enough variation to accurately distinguish director fixed effects for each director: the fitted director fixed effect is an average (at the firm level) of directors' ability. We therefore exclude *ex post* these directors, after performing regressions, when examining the distribution of individual fixed effects across groups. Selection issues are examined in due time.

With these precautions in mind, the most convenient way to compare ability distribution across groups is to perform quantile regressions. We estimate the following model at the directorship level:

$$Q_{FE}(\tau | S_{i,j}, D_i) = \omega + \vartheta_1 S_{ij} + \vartheta_2 D_i + \delta_j + \varepsilon_{ij} \quad (2)$$

where $Q_{FE}(\tau)$ stands for the value of director fixed effect at a decile τ , S_{ij} is a vector of statuses (independent, insider and industry expert), D_i is a vector of individual time-invariant observable characteristics (gender, financial expertise, foreigner, age at the beginning of the period or at the moment of the first appointment), and ε_{ij} the residual. Subscript t is dropped as person effects are, by definition, stable over time. As the dependent variable is estimated (rather than measured), the regressions are bootstrapped with 100 replications. We introduce a whole set of firm identifiers δ_j in model (2): it allows controlling for firm unobservable

heterogeneity that may play a role if directors and companies sort on unobservable components (e.g. if directors with high intrinsic quality goes in highly attractive firm for reputation concerns, see Masulis and Mobbs, 2014). In this model, H6 (adverse selection of independent directors) is corroborated if the correlation $\widehat{\vartheta}_1$ between the independence status and individual fixed effects is significantly negative and stronger for the highest deciles (truncation on the right). In contrast, H7 (reputation-based selection) is validated if this correlation is significantly positive and more intense for the lowest deciles (left truncation).

4. The Data

4.1. Sample Selection

We have collected linked (longitudinal) director-firm data for the SBF120 index that regroups the 120 largest listed firms by market capitalization and by trading volumes on Euronext Paris. Dealing with a restrictive large group of listed companies allows having sufficient director mobility and cross-holdings, insofar as board-level networks are a prominent feature of French corporate capitalism. Ethics&Boards, an international board watching agency, provides us with comprehensive individual data on directors over the 2009-2011 period. Additional hand-collections from annual reports and internet researches enable us to expand the database to the 2006-2011 period. We exclude financial companies and use the Infinancial database to obtain economic and financial information for companies, as well as Thomson One Banker (TOBO) to collect detailed ownership structure. We thus start with a unique matched director-firm dataset including 114 firms and 1,622 distinct directors.

To apply the AKM methodology, we first identify 7 disconnected groups¹². Six of them are single firms, whose directors (mainly blockholder representatives and executives) do not appear in any other SBF120 company over the period; we exclude them from our sample (65 directors). We keep the largest connected group, comprising 108 firms and 1,557 directors (7637 observations). In order to avoid that our estimates be driven by outliers in terms of return, we then trim our measure of operating performance: we exclude all observations with ROE or ROA belonging to the extreme 1% percentiles (68 observations). Finally, we exclude directors who are present only once in our sample period (244 directors or observations) to avoid any confusion between the error term and director fixed effects. We end-up with a slightly unbalanced panel of 1,313 directors sitting in 108 distinct firms over the 2006-2011 period (625 firm-year)¹³. As indicated in Table 1, the panel has 7,325 director-firm-year observations corresponding to 1,821 directorships (a triplet of firm-director-independence status).

¹² To do so, we use the STATA command *felsdvregdm* (Mihaly, McCaffrey, Lockwood and Sass, 2010).

¹³ The unbalanced nature of our panel stems from outliers exclusion as well as from a couple of mergers and acquisitions over the period: in 2008, GDF and Suez merged and gave birth to two new companies (GDF-Suez and Suez Environment), Rhodia was merged with Solvay in 2011, Rexel and Eurotunnel group were created in 2007, and finally Edenred and Apream appears in 2010 (as spinoffs from Accor and Arcelor Mittal respectively).

Table 1: Data distribution

Year	Number of firms	Number of director-firm-year observations
2006	102	1,100
2007	103	1,207
2008	103	1,230
2009	105	1,271
2010	107	1,314
2011	105	1,203
Total	625	7,325

As emphasized in the previous section, the identification power of the AKM approach (in particular, the separate identification of firm and individual effects) depends on having sufficient worker mobility across firms. Similarly, our identification strategy relies on directors sitting in different boards over our sample period. Table 2 below informs on directors' mobility inside our connected group: we observe that 25% of directors (323 out of 1,313) are 'movers' or multiple board holders over the period. Together, these movers represent 45% of our directorships and 43% of our observations.

Table 2: Directors' mobility

Nb of boards	Nb of directors	% of directors	Nb of directorships	% of directorships	Nb of observations	% of observations
1	990	75.40	990	54.37	4,162	56.82
2	212	16.15	424	23.28	1,528	20.86
3	63	4.80	189	10.38	784	10.70
4	28	2.13	112	6.15	420	5.73
5	15	1.14	75	4.12	326	4.45
>5	5	0.38	31	1.70	105	1.43
Total	1,313	100	1,821	100	7,325	100

4.2. Board and firm characteristics: individual and aggregate descriptive statistics

For every director, we obtain the following personal information: gender, age, nationality, past professional experience and educational background¹⁴. Regarding the status, we also know whether the individual is an insider, an affiliated (for instance an employee representative, a blockholder representative or a director with business relationship) or an independent board member. We use the standard AFEP/MEDEF code definition: independence is assumed to be compromised if the director of a company (1) is or has been, within the previous five years, a corporate executive or an employee of that company or of its

¹⁴ All variables are presented in the Appendix section (part 1).

affiliates, (2) is employed as an executive of another company where any of that company's executives sit on the board, (3) has been a director of the company for more than twelve years, (4) is a representative of a large blockholder (with at least 10% of stock or voting rights), (5) has a significant business relationship with that company or its affiliates (as customer, supplier, banker or auditor), (6) is related by close family ties to an executive director.

As previously noted, both industry expertise and financial expertise are now perceived as crucial attributes for independent directors. We choose to define expertise through past or current professional experience (see Reeb and Zhao, 2013 or Dass, Kini, Nanda, Onal and Wang, 2014). A director is then defined as an industry-expert if she has or has had professional experience in the industry (defined with a one-digit code) of the firm where she sits. She is defined as a financial expert if she has or has had professional experience in the insurance or financial service industry. Note that with these definitions, there might be variation across firms for a given individual in the industry expert status, but not in the financial expert status: a director with a past experience in the banking sector is considered once and for all as a financial expert, this experience providing her with some general competencies transferable across companies.

Finally, we examine network impacts via different measures of informal connections. We first intend to check whether sharing informal networks with other board members impact on director efficiency (H4). We suppose that a director is informally connected to the board if she shares with at least one other board member, excluding the CEO, a particular educational background or professional career. Following the sociological literature on business elites in France, as well as empirical evidence brought by Kramarz and Thesmar (2013), we pay particular attention to high-ranking civil servant networks that play an utterly important role in the French corporate system: former or current civil servants with high position, all graduated from the ENA (*Ecole Nationale d'Administration*) or to a lesser extent the *Ecole Polytechnique* (the dominant engineer school), represent a substantial share of directors in large listed companies. We consider director i as being (informally) connected if both i and (at least) one other board member share the same high-civil servant career (i.e. both graduated from the ENA or both graduated from Polytechnique, with a subsequent career as high-civil servant). To test the robustness of our results, we also consider two other broader informal networks:

- *ENA or Polytechnique*: we define a director as connected if graduating from the ENA (resp. *Polytechnique*) while there is another board member coming from the ENA (resp. *Polytechnique*);
- *ENA or Polytechnique or Business schools or IEP*. We substantially enlarge our definition of informal network, including graduation from the three leading French business schools (HEC-ESSEC-ESCP) or from the IEP (*Institut d'Etudes Politiques*, specialized in politic sciences, public and international affairs). Here, a director i is connected if she/he shares one of these four educational backgrounds with at least one other board member.

Concerning connections with the CEO (H5), we focus on networks based on educational background. Once again, we use individual resumes to distinguish four types of diplomas or schools that encompass the most important French institutions regarding the provision of business elites: *Ecole Polytechnique*, ENA, top business Schools (HEC-ESSEC-ESCP), and IEP. We consider that a director i is informally connected to the CEO if they share one of these four types of diplomas.

Table 3: Descriptive statistics at the director level

Variables	Obs	Mean	Median	Std. Dev.
Woman	7,325	0.10	0	0.30
Foreigner	7,325	0.22	0	0.41
Age	7,305	58.81	60	10.08
Independent	7,325	0.49	0	0.50
Insider	7,325	0.09	0	0.29
Industry Expert	7,325	0.55	1	0.50
Industry Expert Independent	7,325	0.19	0	0.39
Financial Expert	7,325	0.57	1	0.49
Financial Expert Independent	7,325	0.29	0	0.45
Directors connected with other board member(s) through high civil-servant network	7,325	0.16	0	0.37
Directors connected with other board member(s) through X-ENA network	7,325	0.24	0	0.43
Directors connected with other board member(s) through X-ENA-Business Schools-IEP network	7,325	0.41	0	0.49
Directors connected with CEO through educational network (<i>CEONET</i>)	7,325	0.28	0	0.45

Summary statistics for directors are presented in Table 3. The proportions of independent directors and insiders inside the boardroom are respectively 49% and 9%, with affiliated directors representing 42%. These statistics are consistent with public figures yearly disclosed by the AMF (*Autorité des Marchés Financiers*). The share of women and foreigners are respectively 11% and 22%. French boards exhibit a substantial feminization over the period, with the share of women going from 7% in 2006 to 17% in 2011 (and from 8% to 21% for the CAC40 companies¹⁵). This movement is the direct consequence of the Law of January 27, 2011, mandating 40% (resp. 20%) of women at the board-level in French listed companies in 2017 (resp. 2014). In contrast, the proportion of foreigners is stable over the period.

Regarding expertise, we have 55% of industry experts and 57% of financial experts. As we stressed previously, combining expertise and independence may help reduce independent directors' informational gap. In our sample, 19% of the directors are industry expert independent and 29% are financial expert independent. Controlling for age, gender,

¹⁵ CAC40 is the leading index on Euronext Paris, including the 40 first listed firms.

nationality and firm industry, the propensity to be an independent director is negatively correlated with industry expertise and non-significantly associated with financial expertise.¹⁶ Our data therefore confirm the idea that independence definition does not favor industry expertise. Finally, directors connected with the CEO through educational network represent 28% of our observations, while connections with other board members represent 16% of observations when we consider the high-ranking civil servant network (and up to 41% with a larger definition for informal network).

Our model uses a mix of individual and aggregate (firm-level) data. Summary statistics for aggregate variables are presented in Table 4¹⁷. We define the following new variables: board size, the proportion of busy directors (with at least one other seat the same year in our sample period), and the proportion of directors aged under 45. French corporate law allows listed companies to choose between a two-tier board structure (with a supervisory board and a management board) and an Anglo-Saxon style unitary structure (one-tier board). In the latter case (chosen by more than three quarters of companies, see Table 4), the positions of chairman of the board and of chief executive may be separated, or not. Both elements (one-tier *versus* two-tier, and separation) are important, insofar as they may impact on the relative power of independent directors *vis à vis* CEO and information asymmetry inside the boardroom (see Belot, Ginglinger, Solvin and Sushka, 2014).

Table 4: Descriptive statistics for board variables

Variables	Obs	Mean	Median	Std. Dev.
Board Size	7,325	13.13	13	3.40
% of Independent Directors	7,325	0.49	0.45	0.20
% of Insider Directors	7,325	0.09	0.08	0.09
% of Industry Expert Directors	7,325	0.55	0.55	0.21
% of Industry Expert Independent Directors	7,325	0.19	0.17	0.17
% of Financial Expert Directors	7,325	0.57	0.58	0.22
% of Financial Expert Independent Directors	7,325	0.29	0.27	0.16
% of Women	7,325	0.10	0.09	0.09
% of Foreigner Directors	7,325	0.22	0.18	0.20
% of Busy Directors	7,325	0.37	0.36	0.19
% of Young Directors (less than 45 years old)	7,325	0.19	0.16	0.16
Supervisory Board	7,325	0.22	0	0.41
Chairman/CEO Separation (one-tier board)	7,325	0.27	0	0.44

¹⁶ We report a point estimate of -0.937 for industry expertise, with a standard error of 0.074 (clustered by director). Controlling for firm fixed effects rather than industry effects increases the point estimate to -1.129 (standard error 0.081). Full results are available upon request.

¹⁷ For the sake of clarity, we have decided to present all the descriptive statistics on a director-firm-year basis (7,325 observations). Table A1 in Appendix (part 2) shows the statistics for aggregate variables on a firm-year basis (625 observations). As it can be seen, differences are very minor.

Regarding firm characteristics, we control for size (proxied by the number of employees, in log) as well as financial leverage, measured as total debt over total equity. To proxy for the propensity of the firm to innovate and to accumulate intangible capital, we use the ratio of R&D expenditures over total sales. We control for long run stock price volatility, a proxy for firm risk, measured as the standard deviation of the monthly stock returns over the previous 50 months. We also control for ownership structure, with the share of outstanding shares held by significant owners (defined as owner with 5% or more of the equity capital). Summary statistics for firm characteristics are presented in Table 5 (see Appendix part 2 Table A.2 for the summary statistics computed with firm-year observations).¹⁸

Table 5: Descriptive statistics for firm variables

Variables	Obs	Mean	Median	Std. Dev.
Number of Employees	7,325	60,019	25,637	81,000
Leverage	7,325	0.90	0.69	1.09
R&D Investment	6,920	0.02	0	0.04
Stock Volatility	7,055	0.54	0.32	2.52
Ownership (float)	7,325	0.40	0.41	0.23
ROA	7,257	0.04	0.04	0.05
ROE	7,283	0.11	0.11	0.13

Regarding performance, we use in all our regressions two different measures, as a way to test the robustness of our results: Return On Equity (ROE) and Return On Assets (ROA). Sample averages (11% for ROE and 4% for ROA) hide striking evolutions over the period, marked by the subprime crisis that negatively impacts firm income statements in 2008 and 2009. Accordingly, profitability ratios are subject to macroeconomic conditions, independent of board composition and other firm-level characteristics. Such variations will be taken into account by introducing year fixed effects in all regressions.

4.3. Selection bias

Our empirical strategy leads to exclude the non-connected firms (7 out of 114) as well as directors with one single observation (255 observations). These exclusions might restrict the relevance of our results. Moreover, both the estimation of coefficients on the independence status and the comparison of individual fixed effects across groups (independent and affiliated) raise selection issues. In the first case, the coefficients are estimated on directors who have some variations in the status (27% of the directorships in our sample). In the second case, we exclude directorships for which director fixed effects are not accurately estimated (38% of directorships). We discuss all these issues in Appendix (part 3, Table A.3 and A.4).

¹⁸ Both stock price volatility and R&D expenditures on sales are missing for some observations. To avoid reducing the sample size in regressions, we set missing values of both variables equal to zero and include for each variable a dummy that equals one if the information is available, zero otherwise. This dummy allows the intercept term to capture the mean of both variables for missing values.

5. Empirical results

5.1. *The independence status and the informational gap*

Table 6 presents the results of our baseline model. Columns (1) to (4) use ROE as dependent variable, while Columns (5) to (8) use ROA. Whatever our measure of performance, Table 6 tells a consistent story about the relationship between independence and performance. Column (1) does not account for independent director heterogeneity, whether observable (industry expertise) or unobservable (director fixed effect). We simply account for unobservable heterogeneity at the firm level (through firm fixed effects), while controlling for firm-level and board-level time-variant characteristics. In this set-up, we do not observe any conditional correlation between the *Independent* dummy and ROE. Results dramatically change when we control for unobservable individual heterogeneity through director fixed effects (Column 2): the association between independence and performance becomes negative and slightly significant (with a corresponding point estimate of -0.011 and a standard error of 0.006).¹⁹ The fact that independence netted out individual ability is negatively related with operating performance is inconsistent with our first hypothesis (H1: conflict-reduction hypothesis). It is indicative of a dark side of the independence status: while we do not directly test it, we suspect that this dark side is somehow imputable to an informational gap experienced by independent directors, as compared to affiliated board members. Furthermore, this result suggests that independent directors are different from affiliated directors, when considering individual attributes irrespective of the status: in particular, it might be the case that independent board members are of a higher ability. Mixing status and personal attributes (in Column 1) hides thus any effect of the *Independent* dummy. Section 5.2 examines this assertion in greater detail.

In Column (3), we finally introduce industry expertise, in isolation and interacted with independence. Point estimate on *Independent* more than doubles (from 0.011 to 0.027) and become significant at the 1% level. This provides further evidence that independent directors may suffer from an informational gap, as top executives may be reluctant to share firm-specific information with shareholder-focused monitors: independence alone, netted out expertise, is negatively related with performance. In contrast, the coefficient on the interaction *Independent*Industry Expert* is positive (+0.038) and significant at the 1% level (standard error: 0.012). This result is consistent with our second hypothesis H2. It echoes the increasing contention that, contrary to 1990s' conventional wisdom, independence alone is not the ultimate solution or criteria regarding board composition: industry-expertise might be as important. To refine this conclusion, we test directly whether the total (net) effect of an independent expert is significantly different from 0 (and positive): the result is not conclusive. However, we find that the total effect of an independent non expert is significantly negative:

¹⁹ The adjusted R-square is slightly reduced (from 0.506 to 0.450), as the number of regressors significantly increase.

the lack of information and expertise seem to impede these board members to efficiently fill their duties (monitoring and advising top management).

Columns (5) to (7) show a pattern of results very similar for ROA: the more we control for individual heterogeneity (through director fixed effects and industry expertise), the higher is in absolute value the coefficient on the *Independent* dummy (from 0.001 to 0.004 and 0.008, with rather stable standard errors of respectively 0.002, 0.002 and 0.003). We also exhibit a positive and significant (at the 5% level) conditional correlation between ROA and the interaction term *Independent*Industry Expert*, with a point estimate of 0.009 (standard error of 0.004). With respect to firm-level variables, we find that companies with higher R&D expenses and higher financial leverage are associated with lower levels of ROA (and ROE for R&D). These findings are largely in line with the prior literature.

We test the robustness of our results in Columns (4) and (8) by introducing director-year fixed effects (instead of director and year fixed effects). In this case, the estimation of coefficients on independence only rests on variation of statuses across companies (rather than inter-firm *and* intra-firm variation). It takes also into account temporal changes in directors' ability and avoids any temporal spurious correlation (simultaneity issue). As previously noted, we excluded from other regressions (Columns 1, 2, 3, 5, 6 and 7) individuals who appear only once over our sample period (as our empirical model cannot in this case separate the individual fixed effect and the residual). To be coherent, we only keep in Columns (4) and (8) individuals who sit in at least two boards over a given year: for the others, our model is not able to distinguish the director-year fixed effect from the error term. We observe that most of our coefficients are fairly stable (for ROE, the coefficient on the *Independent* dummy goes from -0.027 in Column (3) to -0.031 in Column (4), and for ROA from -0.008 in Column (7) to -0.009 in Column (8)). Finally, our results are robust to the elimination of all the observations corresponding to the first year of the directorship (as the influence of newly appointed directors might not be significant during the first months), as well as to the elimination of all the observations corresponding to directors who stay less than three consecutive years in the same company (for a similar approach, see Bertrand and Schoar, 2003). Results are reported in Appendix, part 4, Tables A.5 and A.6.

Table 6: Independence status and operating performance

Variables	(1) ROE	(2) ROE	(3) ROE	(4) ROE	(5) ROA	(6) ROA	(7) ROA	(8) ROA
Independent	-0.002 (0.005)	-0.011* (0.006)	-0.027*** (0.009)	-0.031*** (0.010)	-0.001 (0.002)	-0.004** (0.002)	-0.008** (0.003)	-0.009*** (0.003)
Insider	0.013 (0.011)	0.005 (0.013)	0.009 (0.014)	0.024 (0.015)	0.005 (0.005)	0.002 (0.005)	0.003 (0.005)	0.008** (0.004)
Industry Expert			-0.008 (0.009)	-0.012 (0.010)			-0.002 (0.003)	-0.003 (0.003)
Industry Expert*Independent			0.038*** (0.012)	0.040*** (0.013)			0.009** (0.004)	0.008** (0.004)
% of Independents	-0.026 (0.055)	-0.022 (0.066)	-0.177* (0.094)	-0.300*** (0.087)	-0.009 (0.018)	-0.009 (0.020)	-0.040 (0.026)	-0.076*** (0.023)
% of Insiders	0.157 (0.122)	0.158 (0.131)	0.215 (0.144)	0.474*** (0.157)	0.054 (0.052)	0.039 (0.050)	0.050 (0.051)	0.113*** (0.041)
% of Industry Experts			-0.067 (0.087)	-0.129 (0.085)			-0.014 (0.025)	-0.045** (0.023)
% of Industry Expert Independents			0.390*** (0.121)	0.559*** (0.120)			0.075** (0.033)	0.110*** (0.032)
Chairman/CEO Separation	0.011 (0.015)	0.011 (0.016)	0.011 (0.016)	0.004 (0.019)	0.002 (0.004)	0.002 (0.004)	0.002 (0.004)	0.001 (0.004)
Supervisory Board	0.012 (0.041)	0.022 (0.040)	0.018 (0.041)	-0.007 (0.030)	-0.003 (0.014)	-0.001 (0.013)	-0.001 (0.013)	-0.004 (0.009)
Board Size	0.002 (0.004)	0.003 (0.004)	0.003 (0.004)	0.007* (0.004)	0.002 (0.001)	0.001 (0.001)	0.001 (0.001)	0.003*** (0.001)
% of Women	-0.202** (0.091)	-0.198** (0.096)	-0.164* (0.097)	-0.197* (0.103)	-0.057** (0.027)	-0.051* (0.029)	-0.045 (0.029)	-0.052* (0.028)
% of Foreigners	0.014 (0.095)	0.010 (0.103)	-0.034 (0.099)	-0.058 (0.090)	-0.026 (0.030)	-0.032 (0.030)	-0.041 (0.030)	-0.040* (0.022)
% of Busy Directors	0.040 (0.048)	0.056 (0.052)	0.048 (0.053)	0.065 (0.057)	0.014 (0.015)	0.015 (0.015)	0.013 (0.016)	0.027* (0.016)
% of Young Directors	-0.173*** (0.058)	-0.179*** (0.060)	-0.177*** (0.059)	-0.220*** (0.066)	-0.042*** (0.016)	-0.040** (0.017)	-0.039** (0.017)	-0.050*** (0.018)
Number of Employees (in log)	0.005 (0.026)	0.007 (0.028)	0.015 (0.027)	0.009 (0.028)	0.001 (0.008)	0.001 (0.008)	0.002 (0.008)	-0.001 (0.008)
Leverage	-0.039 (0.032)	-0.039 (0.036)	-0.039 (0.035)	-0.004 (0.037)	-0.007** (0.003)	-0.007** (0.003)	-0.007** (0.003)	-0.007** (0.003)
R&D on Sales	-0.653*** (0.209)	-0.646*** (0.223)	-0.659*** (0.221)	-0.723* (0.386)	-0.246** (0.110)	-0.232** (0.116)	-0.235** (0.116)	-0.274*** (0.103)
Stock Volatility	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	-0.001 (0.002)	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)	0.001* (0.000)
Ownership	-0.098 (0.067)	-0.092 (0.069)	-0.076 (0.067)	-0.051 (0.073)	0.008 (0.023)	0.003 (0.023)	0.007 (0.023)	0.007 (0.020)
Observations	7,283	7,283	7,283	2,589	7,257	7,257	7,257	2,585
Nb of firms	620	620	620	586	619	619	619	586
R ² -adj	0.506	0.450	0.463	0.520	0.655	0.618	0.622	0.711
Director fixed effect	No	Yes	Yes	No	No	Yes	Yes	No
Director-year fixed effect	No	No	No	Yes	No	No	No	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	No	Yes	Yes	Yes	No

Notes: (1) Dependent variable: Return On Equity (columns 1 to 4) or Return On Assets (columns 5 to 8). (2) Directors' controls include: the statuses (independent, insider, industry specific expert) and the interaction term (industry expert*independent) (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 45, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board) and a dummy that takes value 1 in case of separation between CEO and chairman positions in a one tier board (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) Column 1 includes firm and year fixed effects. Columns 2 and 3 include director, firm and year fixed effects. Column 4 includes firm and director-year fixed effects. (6) Robust standard errors, clustered on firm by year, in parentheses. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1.

So far, our results are consistent with the informational gap story. We may ask whether the extent of this informational gap depends on board organization. We investigate this point, by introducing in our baseline model two supplementary interaction terms: being independent in a dualistic structure and being independent in board of directors with Chairman/CEO separation (the reference is then being independent in a one-tier structure with no separation). Results are presented in Table 7, Columns (1) and (2) (for ROE and ROA respectively). We observe that the separation principle in a one-tier board appears favorable to independent board members, with a positive and significant coefficient on the interaction term *Independent*Separation* both for ROE and ROA at a 10% level or better. In contrast, we do not observe any statistical correlation between independence in a two-tier structure and operational performance. These results might be interpreted in light of Belot, Ginglinger, Solvin and Sushka (2014) findings: using French data, they show that two-tier boards (which exacerbate information asymmetry between independent directors and insiders) are chosen when information asymmetries are not too costly and one-tier boards in the opposite case. The positive coefficient we report for independent directors in a one-tier board with separation then suggests that the cost of independent is effectively reduced when information asymmetries are the most costly but the CEO is not too powerful inside the boardroom. In the case of a supervisory board, our result suggests that the extent of the informational gap is not significantly different from the one-tier board without separation case.

Table 7: Independence status, board structure and operating performance

Variables	(1) ROE	(2) ROA
Independent	-0.032*** (0.009)	-0.008*** (0.003)
Insider	0.006 (0.014)	0.003 (0.005)
Industry Expert	-0.006 (0.009)	-0.002 (0.003)
Industry Expert*Independent	0.036*** (0.013)	0.009** (0.004)
Independent*Supervisory Board	0.001 (0.012)	-0.005 (0.004)
Independent*Chairman/CEO Separation	0.017** (0.007)	0.004* (0.002)
Observations	7,283	7,257
Nb of firms	620	619
R ² -adj	0.464	0.622
Firm and board controls	Yes	Yes
Director fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes

Notes: (1) Dependent variable: Return On Equity (columns 1) or Return On Assets (columns 2). (2) Directors' controls include: the statuses (independent, insider, industry expert), the interaction term (industry expert*independent), the board structure interaction term (being independent in supervisory board and being independent in a board with Chairman/CEO separation). (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 45, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board), and a dummy that takes value 1 in case of separation between CEO and chairman positions (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) All regressions include director, firm and year dummies. (6) Robust standard errors, clustered on firm by year, in parentheses. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1

The (positive) role of industry expertise for independent directors is supported by Columns (3) and (6) in Table 6. In Table 8, we propose to test the role of financial expertise, following H3. We introduce in our baseline model a set of interaction terms informing whether a given director can be considered, in light of her past or current professional experience, as having financial literacy. As previously noted, we cannot have inter-firm variation in the financial expert status (contrary to industry expertise). A direct consequence is that we cannot introduce in isolation a dummy, called *Financial Expert*, that takes value 1 if the director is financial expert, 0 otherwise. Yet we can test whether *Financial Expert* interacted with variant board-related statuses bears any statistical relationship with operating performance. We estimate simultaneously five terms: *Industry Expertise*, *Industry Expert*Financial Expert*, *Only Industry Expert*Independent*, *Only Financial Expert*Independent*, and *Financial Expert*Industry Expert*Independent*.

Column (1) presents the regression result with ROE as a dependent variable, and Column (2) with ROA. In contrast with industry expertise, financial expertise alone does not seem to help to bridge independent informational gap: the fitted coefficient on *Independent*Only Financial Expert* is statistically non-significant. H3 is therefore not supported by our data. This might be not surprising, to the extent that this gap concerns firm-specific information; financial literacy cannot, by itself, compensate for a deficit in such type of information (contrary to industry expertise). If anything, this observation indicates that for an independent director to efficiently fulfill its duty, industry expertise may be more important than financial expertise. We note however that the point estimate on *Independent*Industry Expert*Financial Expert* is positive and significant with both measures of performance (+0.061 with a standard error of 0.020, for ROE) and slightly higher than the point estimate on *Independent*Only Industry Expertise*²⁰.

This result supports the idea that the best directors would be like “Jack-of-all-trades”, ultimately combining a set of qualities (independence, specific expertise and general financial literacy) allowing them to fully play their monitoring and advising roles.

²⁰ Nevertheless, the two point estimates are not significantly different.

Table 8: Independence status, financial expertise and operating performance

Variables	(1) ROE	(2) ROA
Independent	-0.048*** (0.017)	-0.014** (0.007)
Insider	0.007 (0.014)	0.003 (0.005)
Industry Expert	-0.022 (0.015)	-0.007 (0.006)
Industry Expert*Financial Expert	0.019 (0.016)	0.007 (0.006)
Only Financial Expert*Independent	0.027 (0.018)	0.008 (0.007)
Only Industry Expert*Independent	0.053** (0.020)	0.012* (0.007)
Financial Expert*Industry Expert*Independent	0.061*** (0.020)	0.016* (0.008)
Observations	7,283	7,257
Nb of firms	620	619
R ² -adj	0.463	0.622
Firm and board controls	Yes	Yes
Director fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes

Notes: (1) Dependent variable: Return On Equity (column 1) or Return On Assets (column 2). (2) Directors' controls include: the statuses (independent, insider, industry expert, financial expert) and the interaction term (industry and financial expert, only industry expert independent, only financial expert independent and industry and financial expert independent) (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, % of industry expert independent, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 50, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board) and a dummy that takes value 1 in case of separation between CEO and chairman positions (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) All models include director, firm and year dummies. (6) Robust standard errors, clustered on firm by year, in parentheses. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1.

Our last empirical investigation regarding the independence status consists in examining the potential role of informal connections. Results are presented in Table 9, Columns (1) to (3) for ROE and (4) to (6) for ROA. In each regression, we simultaneously test the role of informal connections with the CEO and with other board members. Considering ROE (resp. ROA), the difference between Columns (1), (2) and (3) (resp. (4), (5) and (6)) lies in the way we define connections with other directors²¹. In the first Column we use the high-ranking civil servant network, in the second Column we use the X-ENA network and in the third Column the X-ENA-Business schools-IEP. The same principle applies for ROA. To examine the role of informal connections with the CEO, we introduce three new regressors. The first is a dummy that takes value 1 if the director belongs to the CEO network (*CEONET*). The second is an interaction term *Independent*CEONET*Supervisory Board*, with *Supervisory Board* a dummy that equals 1 if there is a two-tier board structure (0 otherwise). This interaction term measures the effect of sharing informal network for an independent director in a supervisory board. The third is a triple interaction term *Independent* CEONET*One-tier Board*, with *One_tier_Board* a dummy that equals 1 if there is a one-tier board structure (0 otherwise). Indeed, we suspect that connections primarily matter in a unitary structure, where the influence of top executives (and the CEO in particular) is more important.

Actually, none of these latter terms are significant whatever the measure of performance: we do not have evidence of any statistical relationships between independent director efficiency and informal connection with the CEO. H5 is not supported. A possible reason has been previously exposed: while sharing social network with the CEO may increase the extent of firm-specific information sharing (thereby implying a positive relationship with operating performance), it also strengthens potential conflict of interests (implying a negative association with performance). Our (non) result might suggest that these effects offset each other.

Looking at informal social connections with other board members, we observe that whatever our measure of performance and the definition used for network, being connected with other board member(s) is significantly associated with greater performance for independent directors when the board structure is unitary. This evidence indicates that the support brought by members of an informal network may be mostly useful when top executives sit at the boardroom. In any case, this finding indicates that the choice between unitary and two-tier board structure is not neutral, as it may affect the balance of power and the interaction framework of directors and managers. More precisely, this echoes the evidence put forward by Belot, Ginglinger, Solvin and Shuska. (2014): in firm with a two-tier board structure, information asymmetries are likely to be a minor issue relative to the private benefit driven by the CEO from running the firm. In this case, having more firm-specific information through social network does not bring much benefit for an independent board member.

²¹ We also consider relationships between directors and the CEO through other directorships the same year. The results are not significant with this proxy of informal connections.

Table 9: Independence status, informal networks and operating performance

VARIABLES	(1) ROE	(2) ROE	(3) ROE	(4) ROA	(5) ROA	(6) ROA
Independent	-0.039*** (0.011)	-0.041*** (0.011)	-0.045*** (0.012)	-0.012*** (0.004)	-0.012*** (0.003)	-0.013*** (0.004)
Insider	0.001 (0.015)	0.001 (0.015)	0.002 (0.014)	-0.000 (0.005)	-0.000 (0.005)	0.000 (0.005)
Industry Expert	-0.008 (0.009)	-0.008 (0.009)	-0.007 (0.008)	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)
Industry Expert* Independent	0.039*** (0.013)	0.039*** (0.013)	0.039*** (0.013)	0.010** (0.004)	0.009** (0.004)	0.010** (0.004)
Independent in Supervisory Board	0.010 (0.012)	0.011 (0.012)	0.023* (0.014)	0.000 (0.004)	0.000 (0.004)	0.003 (0.005)
Independent with Chair/CEO Separation	0.017** (0.008)	0.017** (0.008)	0.016** (0.008)	0.004* (0.002)	0.004* (0.002)	0.003 (0.002)
Director in the CEO network (CEONET)	0.011 (0.019)	0.011 (0.019)	0.012 (0.019)	0.008 (0.005)	0.008 (0.005)	0.008 (0.005)
Independent*CEONET*Supervisory Board	-0.005 (0.022)	0.000 (0.023)	-0.001 (0.023)	-0.003 (0.006)	-0.001 (0.006)	-0.002 (0.006)
Independent*CEONET*One-tier Board	-0.007 (0.016)	-0.007 (0.016)	-0.009 (0.016)	-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.003)
Director from the 'High civil servant' network	-0.011 (0.015)			-0.003 (0.003)		
Director from the X-ENA network		-0.017 (0.012)			-0.002 (0.002)	
Director from the X-ENA-Business Schools-IEP network			-0.000 (0.008)			-0.001 (0.002)
Independent 'civil servant' network in one-tier Board	0.026** (0.011)			0.011*** (0.003)		
Independent 'civil servant' network in Supervisory Board	No obs.			No obs.		
Independent X-ENA network in One-tier Board		0.025*** (0.009)			0.009*** (0.002)	
Independent X-ENA network in Supervisory Board		-0.009 (0.017)			-0.004 (0.006)	
Independent X-ENA-Business Schools-IEP network in One-tier Board			0.026*** (0.009)			0.010*** (0.003)
Independent X-ENA-Business Schools-IEP network in Supervisory Board			-0.018 (0.014)			-0.004 (0.005)
Observations	7,283	7,283	7,283	7,257	7,257	7,257
Nb of firms	620	620	620	619	619	619
R ² -adj	0.464	0.464	0.464	0.623	0.623	0.624
Director fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Dependent variable: Return On Equity (columns 1 to 3) or Return On Assets (columns 4 to 6). (2) Director controls include: the statuses (independent, insider, industry expert), the interaction term (industry expert independent), the board structure interaction term (being independent in supervisory board and being independent in a board with Chairman/CEO separation) and the network variables (directors belonging to the same educational network as the CEO, as other board members X-ENA and X-ENA-Business Schools-IEP and to the high-civil servant network) (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, % of industry expert independent, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 50, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board) and a dummy that takes value 1 in case of the separation between CEO and chairman position (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) All models include director, firm and year dummies. (6) Robust standard errors, clustered on firm by year, in parentheses. (7) Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Summing up, we have tested a model that uses individual inter- (and to a lesser extent intra-) firm variation in status to estimate the relationship between independence and performance, netted out personal intrinsic ability and other time-invariant characteristics. We report evidence of a negative conditional correlation between independence and operating performance that was unobservable when individual heterogeneity was not accounted for. This result is robust to the definition of performance, as well as to a more stringent definition of individual identifiers (director-year fixed effects instead of director fixed effects) and to different methods of standard errors correction. Overall, our findings support the view that, in the French corporate system, the position of independent is a difficult one, fraught with a strong informational gap. We further evaluate the propensity of a set of individual and board-level characteristics to moderate or to magnify the extent of this informational gap. In particular, we report evidence that industry expertise significantly helps independent directors to bridge the informational gap, more than financial literacy. We reach a similar conclusion for a split in CEO and chairman positions, as well as for informal connections with other board members in a unitary board structure.

5.2. *Independent directors' selection*

Our results provide evidence that the status of independent is associated with a lower level of operating performance *only once* individual time-invariant heterogeneity is taken into account through director fixed effects. This evidence, in turn, suggests that independent directors have specific attributes positively related with performance. Figures 2 and 3 below confirm this idea, by plotting the distribution of fitted individual fixed effects for independent and non-independent directors driven from the baseline model (1') (Table 6, Columns 3 and 7), with ROE (fig. 2) and ROA (fig. 3). As detailed in the Appendix (part 3), we only consider individual fixed effects that are accurately estimated. If anything, both figures indicate that fixed effects distribution for independent board members is left-truncated. However, this observation is not sufficient to confirm that independent directors' appointment is characterized by a selection process based on intrinsic ability – in this case, a reputation-based selection process. Estimated fixed effects capture all time-invariant individual attributes, including intrinsic ability, and are influenced by some observable characteristics like gender, financial expertise, etc., some of which are likely to be correlated with operating performance. Regarding these characteristics, independent director and non-independent director populations may significantly differ due to the director labor market structure for independent directors. In this case, the distribution pattern of individual fixed effect would be driven by other observable director attributes more than by intrinsic ability or talent. To refine our conclusion, we perform multivariate quantile estimations, where fixed effects are regressed on the independent and insider statuses, gender, nationality, expertise (industry and financial), a dummy that takes value 1 if the individual has more than one directorship over the period²² and firm fixed effects²³. We choose the baseline model with independence and industry expertise (Columns 3 and 7, Table 6) to extract directors' fixed effects (other models, for example with financial expertise, might be used, without consequences on our main results). Results are presented in Table 10, panel A for ROE and panel B for ROA.

²² We introduce this dummy to avoid having a spurious relationship between the independent status and director ability. Indeed, we suspect (and test the fact) that the most talented directors have a higher propensity to be appointed inside a boardroom as independent directors. At the same time, these directors are likely to have a good external reputation, and therefore to be appointed in multiple boards over the period (see Masulis and Mobbs, 2011 for a similar analysis about insider directors). Due to our estimation methodology, these latter directors are more likely to have their fixed effect accurately estimated than directors with a single-directorship.

²³ Firm fixed effects enable to control for prestige or firm-reputation effects (See Masulis and Mobbs, 2014). The most talented independent directors may have a greater incentive to work for the most visible and prestigious firms. However, our main question is to investigate whether within the same firm, there is a significant difference between independent and non-independent directors in terms of intrinsic ability.

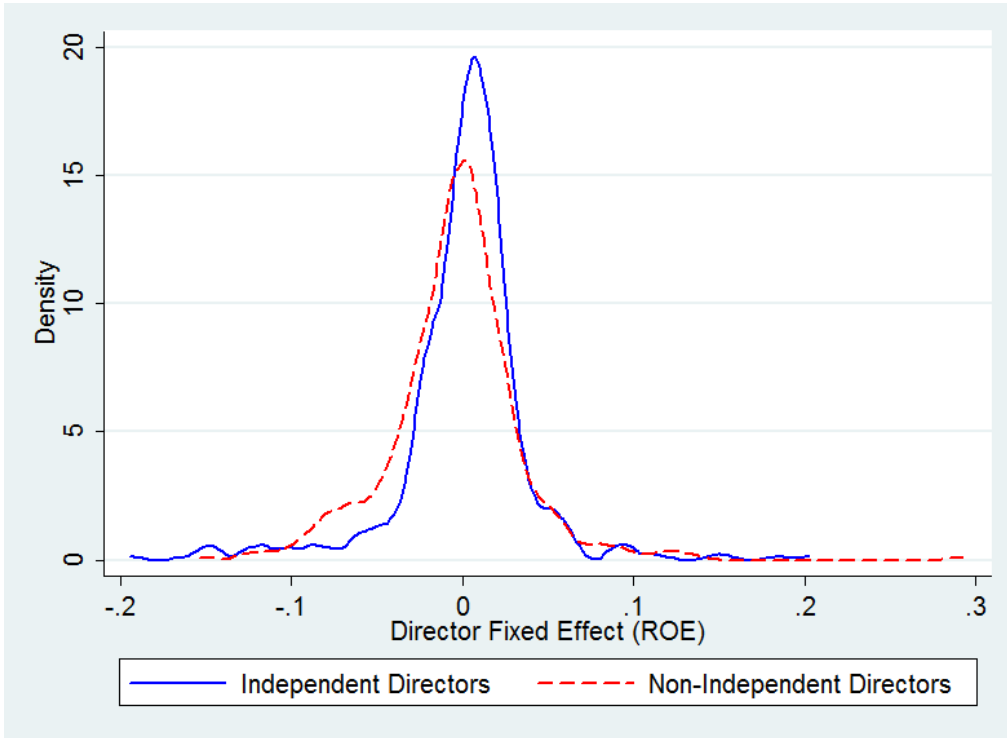


Figure 2: Director fixed effects' distribution (ROE)

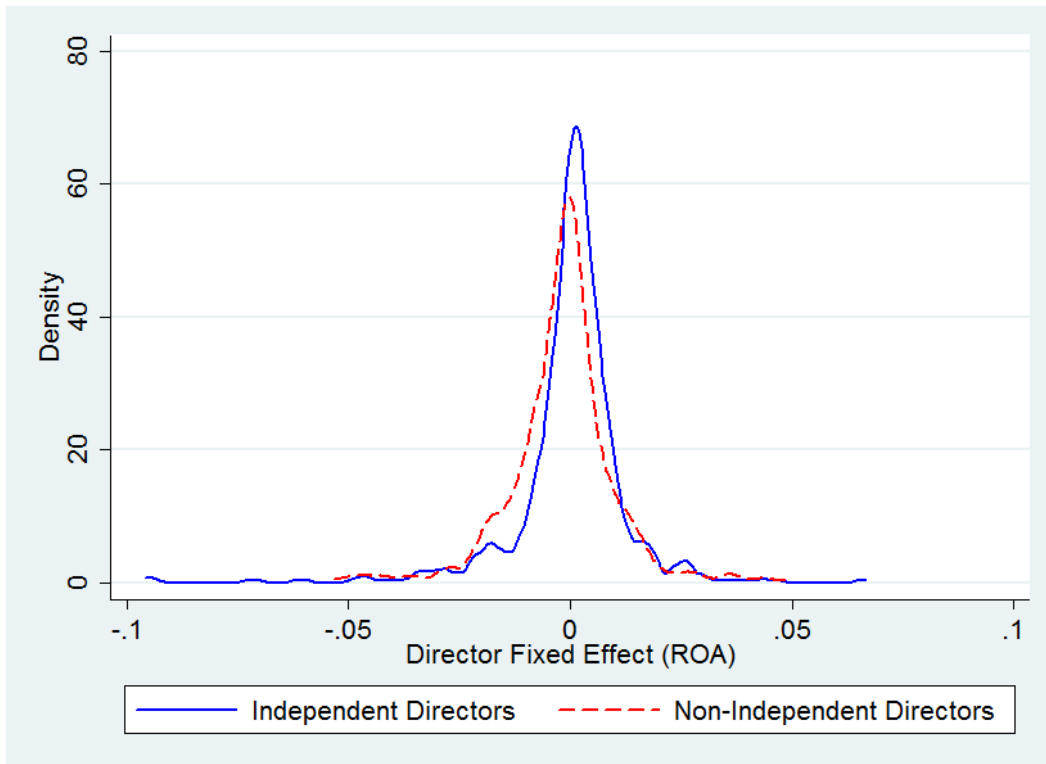


Figure 3: Director fixed effects' distribution (ROA)

Table 10: Director fixed effects and independence (quantile regressions)

Panel A: ROE

Variables	(1) 10th	(2) 20th	(3) 30th	(4) 40th	(5) 50th	(6) 60th	(7) 70th	(8) 80th	(9) 90th
Independent	0.014*** (0.003)	0.009*** (0.002)	0.009*** (0.002)	0.007*** (0.002)	0.007*** (0.002)	0.006*** (0.002)	0.005*** (0.002)	0.006*** (0.002)	0.006*** (0.002)
Insider	0.015*** (0.005)	0.012*** (0.004)	0.011*** (0.003)	0.009*** (0.003)	0.008*** (0.003)	0.009*** (0.003)	0.012*** (0.003)	0.015*** (0.003)	0.016*** (0.004)
Industry Expert	0.004 (0.003)	0.000 (0.002)	0.000 (0.002)	0.001 (0.002)	-0.001 (0.002)	-0.002 (0.002)	-0.003* (0.002)	-0.004* (0.002)	-0.003 (0.002)
Woman	-0.001 (0.004)	-0.004 (0.004)	-0.003 (0.004)	0.003 (0.004)	0.003 (0.004)	0.005* (0.003)	0.008** (0.003)	0.009** (0.004)	0.016*** (0.004)
Foreigner	0.001 (0.004)	0.003 (0.003)	0.001 (0.003)	0.003 (0.002)	0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.000 (0.002)	-0.002 (0.003)
Age	0.012 (0.016)	0.022* (0.012)	0.016 (0.010)	0.003 (0.009)	-0.005 (0.010)	-0.003 (0.010)	-0.004 (0.010)	-0.019* (0.010)	-0.020* (0.012)
Financial Expert	0.005 (0.003)	0.002 (0.002)	0.003 (0.002)	0.001 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	-0.001 (0.002)	-0.001 (0.002)
Multi- directorships	0.004 (0.004)	0.005* (0.003)	0.004 (0.003)	0.004 (0.003)	0.002 (0.002)	-0.000 (0.002)	-0.001 (0.002)	-0.002 (0.002)	-0.005** (0.002)
Observations	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126	1,126
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: ROA

VARIABLES	(1) 10th	(2) 20th	(3) 30th	(4) 40th	(5) 50th	(6) 60th	(7) 70th	(8) 80th	(9) 90th
Independent	0.004*** (0.001)	0.003*** (0.001)	0.002*** (0.001)	0.003*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002** (0.001)
Insider	0.003 (0.002)	0.002 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.002 (0.001)	0.003** (0.002)
Industry Expert	0.000 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.001 (0.000)	-0.000 (0.000)	-0.001 (0.001)	-0.001** (0.000)	-0.001** (0.001)	-0.001 (0.001)
Woman	-0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.002** (0.001)	0.003*** (0.001)	0.006*** (0.002)
Foreigner	0.002** (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)
Age	0.005 (0.004)	0.005* (0.003)	0.002 (0.003)	-0.001 (0.003)	-0.002 (0.003)	-0.003 (0.003)	-0.004 (0.003)	-0.003 (0.003)	-0.001 (0.004)
Financial Expert	0.001 (0.001)	0.001* (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)
Multi- directorships	0.004*** (0.001)	0.003*** (0.001)	0.002** (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	-0.001* (0.001)	-0.001** (0.001)	-0.002*** (0.001)
Observations	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Dependent variable: Director fixed effect computed with Return On Equity (Panel A) or Return On Assets (Panel B). (2) Director controls include: the statuses (independent, insider, industry expert, financial expert), the age, the gender and foreigner dummies, as well as a dummy for multi-directorships (3) All models include firm fixed effects. (4) Robust standard errors in parentheses. (5) Significance: *** p<0.01, ** p<0.05, * p<0.1.

We observe that, whatever the measure of performance, there is a positive conditional correlation between individual fixed effects and the independent status that diminishes when climbing the deciles. For ROE, the point estimate is 0.014 for the first decile and 0.006 for the last decile, with rather similar standard errors (0.002 and 0.003). The same pattern is observable for ROA, with a coefficient that goes from 0.004 to 0.002, and a stable standard error (0.001). Clearly, this decrease in point estimates along the distribution is suggestive of a left-truncation for the distribution of independent directors' ability, as compared to the distribution for affiliated board members. This result, consistent with a selection process driven by reputation, corroborates H7. As a robustness check, we re-run our quantile regressions keeping all directorships: the results are consistent (see Appendix part 4, Table A.7).

Interestingly, we note that, at least in the case of ROE, the insider status is also positively related with individual fixed effect. It indicates that, in contrast with affiliated directors, a selection process based on ability is also at stake concerning insiders: it confirms that individuals that become top executives are rather high ability agents, able to manage large and complex companies. Nevertheless, the fact that the coefficient is stable over deciles is suggestive of a selection process based on professionalization rather than on reputation (distribution is right-shifted relative to the affiliated distribution, rather than left-truncated). For women, from the 70th quantile, director fixed effects are slightly higher than male director fixed effects, suggesting a positive selection effect for female directors (maybe due to a rather low demand relative to supply²⁴). For the multi-directorships directors, the results show both a left-truncated distribution (significant positive coefficients for the lowest deciles) and a right-truncation (negative significant coefficients for the highest deciles). We suspect that the left-truncation occurs as a result of a reputation-based selection process, while the right-truncation occurs as the most talented individuals might not share their time in multiple boards or may be an executive in another firm.

Overall, our results are consistent with the idea that independent directors are (positively) selected on the basis of their individual intrinsic ability, as the appointment process is under strong scrutiny by shareholders (reputation-based selection).

²⁴ Women represent 15% of directors belonging to the 70th and higher quantiles whereas they represent only 10% in the rest of the director population.

6. Endogeneity issues

In this paper, we use an AKM-style empirical model to identify three separate factors of firm operating performance, in addition to traditional time-varying covariates (see model 1): a firm component δ_j , a director component μ_i and a status component $Independent_{i,j,t}$ (and others such as industry-expertise). The firm component is a time-invariant factor of performance, homogenous across directors. Likewise, the director component is a time-invariant performance factor, homogenous across companies. The status component is a time-invariant performance factor, homogenous across directors and firms. For these parameters of interest to be correctly estimated, the three following orthogonality conditions should hold:

$$\begin{aligned} E[\delta_j; \varepsilon_{i,j,t}] &= 0 \quad \forall j \\ E[\mu_i; \varepsilon_{i,j,t}] &= 0 \quad \forall i \\ E[Independent_{i,j,t}; \varepsilon_{i,j,t}] &= 0 \quad \forall i, \forall j \end{aligned}$$

The first two of these conditions rest on one key identifying assumption, namely an “exogenous mobility” assumption (Card, Heining and Kleine, 2013). Intuitively, if the data-generating process is such that some directors bring more value to certain types of firm, then our empirical strategy will fail to capture time-invariant firm and director components. In this case, the additive separability of firm and director effects should be abandoned: the error term $\varepsilon_{i,j,t}$ would consist of two distinct components, a match component $\varphi_{jI(j,t)}$ and a pure error term $r_{j,t}$, so that $\varepsilon_{i,j,t} = \varphi_{jI(j,t)} + r_{j,t}$. The match component represents an idiosyncratic performance effect brought by director i at firm j , relative to the baseline level $\mu_i + \delta_j$.

We perform two distinct tests of the additive separability assumption, following Card, Heining, and Kline (2013) and Flabbi, Macis, Moro and Shibardi (2013).

A primary convenient way to assess the soundness of an empirical model is to look at residuals: high residuals, specifically related to some covariates, are a first indication that something goes wrong. In our case, we are mainly interested in the relationships between residuals and fitted (firm and director) fixed effects when additive separability is assumed. Using our baseline regression, we only keep observations for which individual fixed effects are correctly estimated and trim these fixed effects at the 1% and 99% levels. We then sort directors and firms into deciles according to their fitted fixed effects, and cross these deciles to obtain 100 groups or matches. Figures 4 and 5 present the average residuals for each of these groups $\overline{\varepsilon_{i,j,t}}$. If our additive separable model is erroneous, we expect to observe high values of (mean) residuals being concentrated on particular matches. We do not have evidence of such pattern. Looking at ROE first (figure 4), we see that in only 7 times out of 100 are residuals greater than 0.02 (in absolute value), less than half of the standard deviation of estimated fixed effects. Moreover, important deviations do not appear to be concentrated on particular matches; they rather seem to be randomly disseminated over the all distribution.

The same comment applies for ROA (figure 5), with deviations greater than 0.005 (in absolute value) in only 10 cases out of 100, and no systemic pattern in their occurrence.

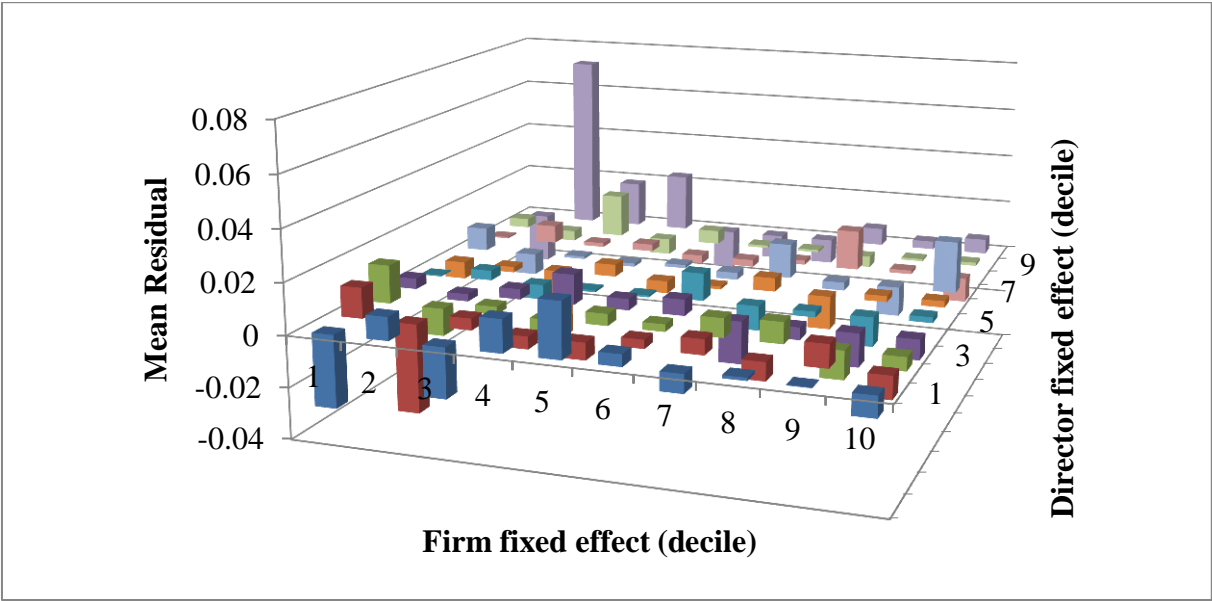


Figure 4: Mean residuals by director and firm fixed effect deciles (ROE)

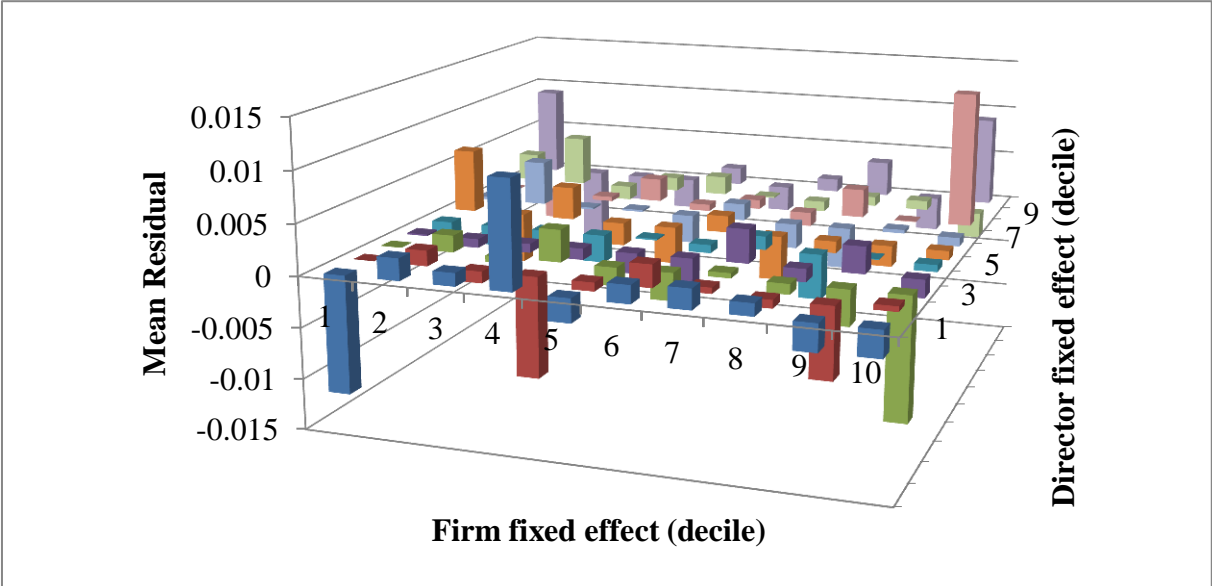


Figure 5: Mean residuals by director and firm fixed effect deciles (ROA)

As a second test we fit a fully saturated model that includes a separate dummy for each director-firm match, instead of (1'). Does this saturated model outperform our baseline, additive separable model? The answer is negative, as evidenced in Table 11. The first three Columns report three models with ROE as a dependent variable: Column (1) does not include any fixed effects (except year dummies), Column (2) includes firm fixed effects and director fixed effects and Column (3) includes firm-director fixed effects (saturated model). The last three Columns (4, 5 and 6) replicate this approach for ROA. We observe that for ROE, R-square only increases of 1.9% when passing from an additive separable (Column 2) to a saturated model (Column 3), while adjusted R-square slightly decreases, from 0.463 to 0.452. In comparison, the inclusion of firm and director fixed effects (from Column 1 to Column 2) increases R-square from 46%. Evolutions in R-square are of the same magnitude regarding ROA. These results clearly suggest that omitting the match component does not undermine the explicative power of our model.²⁵

²⁵ Interestingly, we observe that the coefficient on the *Independent* dummy dramatically increases (with a point estimate multiplied by four for ROE and by five for ROA) with a saturated model. This rise is due to the fact that with a match component, the coefficient on *Independent* is estimated on directors that change status within the same firm (intra-firm variation), but not on directors that have variation across firms. As a consequence, the explanatory power of the (aggregate) share of independent directors is reduced, to the benefit of the individual dummy *Independent*.

Table 11: Independence status and operating performance: a fully saturated model

Variables	(1) ROE	(2) ROE	(3) ROE	(4) ROA	(5) ROA	(6) ROA
Independent	-0.011*** (0.004)	-0.027*** (0.009)	-0.120** (0.050)	-0.003** (0.001)	-0.008** (0.003)	-0.046** (0.020)
Insider	0.016*** (0.005)	0.009 (0.014)	0.040* (0.024)	0.006*** (0.002)	0.003 (0.005)	0.012 (0.009)
Industry Expert	-0.003 (0.004)	-0.008 (0.009)		-0.002 (0.001)	-0.002 (0.003)	
Industry Expert*Independent	0.012** (0.005)	0.038*** (0.012)	0.131** (0.064)	0.002 (0.002)	0.009** (0.004)	0.049* (0.026)
% of Independents	-0.124*** (0.039)	-0.177* (0.094)	-0.153 (0.101)	-0.030** (0.014)	-0.040 (0.026)	-0.038 (0.028)
% of Insiders	0.201*** (0.055)	0.215 (0.144)	0.192 (0.150)	0.068*** (0.019)	0.050 (0.051)	0.040 (0.055)
% of Industry Experts	-0.046 (0.039)	-0.067 (0.087)	-0.056 (0.093)	-0.017 (0.012)	-0.014 (0.025)	-0.013 (0.027)
% of Industry Expert Independents.	0.138** (0.056)	0.390*** (0.121)	0.350*** (0.125)	0.019 (0.017)	0.075** (0.033)	0.071** (0.035)
Chairman/CEO Separation	-0.007 (0.012)	0.011 (0.016)	0.013 (0.016)	0.008* (0.004)	0.002 (0.004)	0.002 (0.004)
Supervisory Board	0.014 (0.017)	0.018 (0.041)	0.027 (0.042)	0.013** (0.006)	-0.001 (0.013)	0.001 (0.014)
Board Size	-0.001 (0.002)	0.003 (0.004)	0.002 (0.004)	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
% of Women	0.070 (0.056)	-0.164* (0.097)	-0.173* (0.101)	0.032* (0.019)	-0.045 (0.029)	-0.046 (0.030)
% of Foreigners	0.024 (0.027)	-0.034 (0.099)	-0.039 (0.107)	-0.003 (0.010)	-0.041 (0.030)	-0.039 (0.032)
% of Busy Directors	-0.041 (0.030)	0.048 (0.053)	0.053 (0.054)	-0.010 (0.011)	0.013 (0.016)	0.014 (0.016)
% of Young Directors	-0.064* (0.035)	-0.177*** (0.059)	-0.170*** (0.060)	0.004 (0.012)	-0.039** (0.017)	-0.038** (0.018)
Number of Employees (in log)	0.003 (0.003)	0.015 (0.027)	0.013 (0.029)	-0.003** (0.001)	0.002 (0.008)	0.002 (0.008)
Leverage	0.014 (0.011)	-0.039 (0.035)	-0.039 (0.037)	-0.008*** (0.002)	-0.007** (0.003)	-0.008** (0.003)
R&D on Sales	-0.145 (0.128)	-0.659*** (0.221)	-0.667*** (0.231)	0.035 (0.045)	-0.235** (0.116)	-0.240** (0.122)
Stock Volatility	0.001 (0.001)	0.002 (0.002)	0.002 (0.002)	-0.000 (0.000)	0.001 (0.000)	0.001 (0.000)
Ownership	0.006 (0.027)	-0.076 (0.067)	-0.070 (0.069)	0.004 (0.009)	0.007 (0.023)	0.008 (0.024)
Observations	7,283	7,283	7,283	7,257	7,257	7,257
Nb of firms	620	620	620	619	619	619
R-squared	0.112	0.570	0.589	0.178	0.697	0.710
R2-adj	0.109	0.463	0.452	0.175	0.622	0.613
Director fixed effect	No	Yes	No	No	Yes	No
Director-Firm fixed effect	No	No	Yes	No	No	Yes
Firm fixed effect	No	Yes	No	No	Yes	No
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Dependent variable: Return On Equity (Columns 1, 2 and 3) or Return On Assets (Columns 3, 4 and 5). (2) Directors' controls include: the statuses (independent, insider, industry expert) and the interaction term (industry expert*independent) (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 45, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board), and a dummy that takes value 1 in case of separation between CEO and chairman positions (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) All models include year dummies. (6) Columns (2) and (4) include firm fixed effects and directors fixed effects. (7) Columns (3) and (6) include director-firm fixed effects. (8) Robust standard errors, clustered on firm by years, in parentheses. (9) Significance: *** p<0.01, ** p<0.05, * p<0.1.

The last orthogonality condition, namely $[Independent_{i,j,t}; \varepsilon_{j,t}] = 0$, makes sure that the fitted coefficient on *Independent* actually measures the net effect of the independence status on performance, irrespective of firm and director identifiers. A possible violation of this condition will occur in case of so called 'dynamic endogeneity', that is if firms typically hire more (or less) independent directors (with more or less intrinsic ability) depending on their past or current performance (see Wintoki, Linck and Netter, 2012). We perform three distinct tests to probe the validity of the dynamic exogeneity assumption: each of these tests consider the relationship between firm performance and the independence status.

A first possible test for the existence of dynamic endogeneity has been performed in section 5, with the introduction of director-year fixed effects (instead of director fixed effects). We observed in Table 6, Columns (4) and (8) that the coefficients on *Independent* are not reduced: this means that the effect of *Independent* is netted out personal ability *and* business cycle effects that may impact firm performance.

A second, more direct test, consists in observing whether there is a relationship between firm performance in $t-1$ and the probability P_{ijt} for a director i to be appointed in firm j in year t as independent (rather than as a non-independent director). A significant correlation would strongly suggest the presence of dynamic endogeneity. In Column (1) (resp. 2) in Table 12 we run a logit regression of P_{ijt} on ROE (resp. ROA) in $t-1$ and a set of firm (board and financial variables) and individual (age, gender, nationality, industry expertise and financial expertise) covariates. Point estimates on lagged performance are not significant at conventional levels.

In Columns (3) and (3'), we split the independent category between high ability independent directors and low ability independent directors, and run a multinomial logit regression with ROE as dependent variable. We do not have evidence of firms appointing more high ability independent board members when performance is low or the opposite (low ability when performance is high). The same is true when using ROA instead of ROE (Columns 4 and 4'). In light of these results, we believe that dynamic endogeneity is unlikely to drive our estimates.

Table 12: Dynamic endogeneity, independent director selection and operating performance

VARIABLES	(1)	(2)	(3)	(3')	(4)	(4')
	Independent	Independent	Low ability independent	High ability independent	Low ability independent	High ability independent
Lagged ROE	-0.096 (0.574)		-0.106 (0.563)	-0.070 (0.739)		
Lagged ROA		1.559 (1.790)			2.454 (2.019)	0.725 (2.088)
Age	0.068*** (0.012)	0.069*** (0.012)	0.080*** (0.013)	0.056*** (0.014)	0.082*** (0.013)	0.057*** (0.014)
Woman	1.004*** (0.274)	1.010*** (0.276)	1.020*** (0.341)	1.009*** (0.288)	1.028*** (0.346)	1.010*** (0.291)
Foreigner	0.382 (0.283)	0.386 (0.284)	0.774*** (0.300)	-0.068 (0.329)	0.776*** (0.301)	-0.063 (0.330)
Industry Expertise	-1.478*** (0.212)	-1.486*** (0.212)	-1.530*** (0.255)	-1.437*** (0.284)	-1.542*** (0.251)	-1.444*** (0.286)
Financial Expertise	-0.033 (0.191)	-0.010 (0.193)	-0.022 (0.234)	-0.041 (0.233)	0.010 (0.236)	-0.029 (0.236)
Observations	620	620	620	620	620	620
R ² -adj	0.19	0.19	0.16	0.16	0.16	0.16
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Dependent variables: a dummy that takes value 1 if director i is appointed as independent (0 otherwise) in Columns 1 and 2, a variable that takes value 1 if director i is appointed as a low ability director, 2 as a high ability director, and 0 otherwise (columns 3 and 4). (2) Director controls include: age, gender and foreigner dummies, financial and industry expertise (3) Board controls include: lagged % of independent directors, lagged % of insiders, lagged % of industry expert directors, lagged board size, lagged % of women, lagged % of foreigners, lagged % of busy directors (with at least one other directorship the same year), lagged % of young directors aged less than 45, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board), and a dummy that takes value 1 in case of separation between CEO and chairman positions (0 otherwise). (4) Firm controls includes: lagged ROE or ROA., size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership (5) Robust standard errors, clustered on director, in parentheses. (6) Method: logit (1 and 2) and multi-nomial logit (3 and 4) regressions. (7) Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

7. Conclusion

The main contribution of this article is to investigate in a unified empirical framework the relationships between board functioning and director selection on one side, and firm operating performance on the other side. It is important insofar as a growing body of empirical and theoretical research pinpoints that board efficiency is the result of an equilibrium between board functioning and selection process (Adams, Hermalin and Weisbach, 2010). In parallel, director selection is increasingly recognized as a crucial (and until recently somewhat neglected) aspect of the governance/performance context (see Knyazeva, Knyazeva and

Masulis, 2013 or, for a multi-disciplinary review, Withers, Hillman and Cannella, 2012). Our study brings new insights into this governance/performance context. Most of the papers blame so-called “dynamic endogeneity” (i.e. the appointment of independent directors when the firm experiences poor performance) to explain the lack of strong results regarding board independence and performance. We highlight two other reasons: the heterogeneity of independent directors in terms of board-related attributes and in terms of intrinsic ability, whereas we observe a small influence of dynamic endogeneity in our data and analysis.

Our empirical strategy consists in applying the AKM statistical framework to matched director-firm data so as to separately identify firm (fixed) effects, director (fixed) effects, and status effects (e.g. independence and expertise) in firm performance equation. To our knowledge, this is the first systematic application of the AKM approach, initially developed in labor economics, to the board/performance context. We obtain three main results, on a representative sample of large non-financial French listed companies (the SBF120) for the 2006-2011 period.

First, we find evidence that independence, netted out individual heterogeneity (both observable and unobservable), is negatively correlated with operating performance. This result is robust to alternative definitions of fixed effects (director-year or firm-director effects) or corrections of standard errors (firm-year *versus* two-ways firm-year and director clusterisation), as well as to sample variations (elimination of short term directorships, for instance). We interpret this observation as an (indirect) evidence of an informational gap experienced by independent board members, as CEOs may be reluctant to share in firm-specific information.

Second, we identify a set of (board-related) attributes that may help independent directors to reduce the magnitude of this informational gap. In particular, we find that industry-expertise, while not so common among independent board members, is a key ingredient in this perspective, just like informal connections with other board members. In the same vein, we provide evidence that the separation of Chairman and CEO positions in a one-tier structure increases independent directors’ effectiveness.

Third, while independent directors appears to be less informed, we show that they are also probably better selected than affiliated board members, at least in term of individual intrinsic ability. We derive this conclusion from a careful comparison of fixed effect distributions across both groups of directors: netted out observable individual attributes and firm (unobservable) heterogeneity, we find that the independent directorship fixed effects distribution is left-truncated. We argue that this left truncation occurs as a result of a reputation-based selection process that comes to play in the appointment of independent board members. We are not aware of any other papers in corporate finance using individual fixed effects to compare distributions across groups and to derive results on selection.

At last, our empirical investigation suggests that the main issue in current corporate governance is board functioning rather than selection. From a policy point of view, this consideration paves the way for a reflection on regulatory mechanisms able to narrow the informational gap. Three comes in mind: industry expertise requirements, information disclosure (albeit it has gained considerable importance over the last two decades, at least in France) and the separation between chairman and CEO positions in a one-tier board system (that we found positively correlated with independent director effectiveness).

To conclude, we wish to underline that our results are not inconsistent with an equilibrium model, once taken into account that large companies appoint independent board members (not only but) primarily to fulfill regulatory or market requirements, at least in the U.S., the U.K or France. In this context, independent board members are better selected than affiliated ones, as shareholders have a set of observable attributes to assess *ex ante* the ability of these directors. Reputation-based selection is but one part of the story, as it stops at the gate of the boardroom: beyond, shareholders do not have direct, visible signs to assess board functioning adequacy. And as highlighted by several studies, firm-specific information retention by CEOs is a rational (game-theoretic) equilibrium (Adams and Ferreira, 2007). Now, given our result on industry expertise and informal network affiliation, the key questions are the following: how expertise and connection currently matter in the director selection process and why do not all firms appoint expert and connected independent directors? Different answers might be provided. It is possible that shareholders are not still aware that these criteria have substantial impact regarding independent director efficiency (with a focus by regulators on financial expertise), or that finding high ability independent directors with expertise and connection is a costly process (narrowness of the pool of potential directors and increase in the demand). It is also possible that the appointment of such independent board members is part of strategic behavior by top executives to circumvent regulatory or market requirements. At this stage, we are not able to discriminate between these different hypotheses; at least, it calls for a careful examination of the characteristics of firms and boards that appoint expert or connected independent members. What is the real power of the CEO and the impact of (different kind of) networks on the identification of talents and attributes? Are nominating committees really efficient to mitigate the influence of CEOs on director selection? Do firms with different informational environment face different constraints regarding the appointment of independent directors? The French Act mandating quota of female directors inside the boardroom should be a good natural experiment to investigate these issues. From this point of view, network analysis is one of the most promising research avenues to better understand the board dynamics and the role of each individual director.

References

- Abowd, J. M., Creecy, R. H., & Kramarz, F. (2002). Computing person and firm effects using linked longitudinal employer-employee data (No. 2002-06). *Center for Economic Studies, US Census Bureau*.
- Abowd, J. M., Kramarz, F., & Margolis, D. N. (1999). High wage workers and high wage firms. *Econometrica*, *67*(2), 251-333.
- Adams, R. B., & Ferreira, D. (2007). A theory of friendly boards. *The Journal of Finance*, *62*(1), 217-250.
- Adams, R. B., Hermalin, B. E., & Weisbach, M. S. (2010). The role of boards of directors in corporate governance: A conceptual framework and survey. *Journal of Economic Literature*, *48*(1), 58-107.
- Arena, M. P., & Braga-Alves, M. V. (2013). The discretionary effect of CEOs and board chairs on corporate governance structures. *Journal of Empirical Finance*, *21*, 121-131.
- Armour, J., Deakin, S., Lele, P. & Siems, M. (2009). How do legal rules evolve? Evidence from a cross-national comparison of shareholder, creditor and worker protection. *American Journal of Comparative Law*, *57*, 579-630.
- Baysinger, B., & Hoskisson, R. E. (1990). The composition of boards of directors and strategic control: Effects on corporate strategy. *Academy of Management review*, *15*(1), 72-87.
- Bebchuk, L. A., & Fried, J. M. (2004). *Pay without performance* (Vol. 278). Cambridge, MA: Harvard University Press.
- Belot, F., Ginglinger, E., Slovin, M. B., & Sushka, M. E. (2014). Freedom of choice between unitary and two-tier boards: an empirical analysis. *Journal of Financial Economics*, *112*(3), 1-22.
- Bertrand, M., & Schoar, A. (2003). Managing with style: The effect of managers on firm policies. *The Quarterly Journal of Economics*, *118*(4), 1169-1208.
- Bhagat S. & Black B., (1999). The uncertain relationship between board composition and firm performance. *Business Lawyer*, *54*, 921-963.
- Bhagat, S. & B. Bolton, (2008). Corporate governance and firm performance. *Journal of Corporate Finance*, *14*, 257-273.
- Bhagat, S. & Bolton, B. (2013). Director ownership, governance and performance. *Journal of Financial & Quantitative Analysis*, *48*(1), 105-135.

- Burak Güner, A., Malmendier, U., & Tate, G. (2008). Financial expertise of directors. *Journal of Financial Economics*, 88(2), 323-354.
- Cai, J., Garner, J. L., & Walkling, R. A. (2009). Electing directors. *The Journal of Finance*, 64(5), 2389-2421.
- Carcello, J. V., Hermanson, D. R., & Ye, Z. (2011). Corporate governance research in accounting and auditing: Insights, practice implications, and future research directions. *Auditing: A Journal of Practice & Theory*, 30(3), 1-31.
- Card, D., Heining, J., & Kline, P. (2013). Workplace heterogeneity and the rise of West German wage inequality. *The Quarterly Journal of Economics*, 128(3), 967-1015.
- Cohen, L., Frazzini, A., & Malloy, C. (2008). The small world of investing: Board connections and mutual fund returns. *Journal of Political Economy*, 116(5), 951-979.
- Cohen, L., Frazzini, A., & Malloy, C. (2010). Sell-side school ties. *The Journal of Finance*, 65(4), 1409-1437.
- Cohen, L., Frazzini, A., & Malloy, C. J. (2012). Hiring cheerleaders: Board appointments of “independent” directors. *Management Science*, 58(6), 1039-1058.
- Coles, J., Daniel, N., & Naveen, L. (2012). Board advising. *Unpublished Working Paper. Arizona State University.*
- Coles, J. L., Daniel, N. D., & Naveen, L. (2014). Co-opted boards. *Review of Financial Studies*, 27(6), 1751-1796.
- Coles, J. L., & Li, Z. F. (2013). Managerial attributes, incentives, and performance. *Unpublished Working Paper. Available at SSRN, <http://papers.ssrn.com/abstract=1680484>.*
- Cook, D. O., & Wang, H. B. (2011). The informativeness and ability of independent multi-firm directors. *Journal of Corporate Finance*, 17(1), 108-121.
- Dass, N., Kini, O., Nanda, V., Onal, B., & Wang, J. (2014). Board expertise: Do directors from related industries help bridge the information gap? *Review of Financial Studies*, 25(7), 1533-1592.
- DeFond, M. L., Hann, R. N., & Hu, X. (2005). Does the market value financial expertise on audit committees of boards of directors? *Journal of Accounting Research*, 43(2), 153-193.
- Duchin, R., Matsusaka, J. G., & Ozbas, O. (2010). When are outside directors effective? *Journal of Financial Economics*, 96(2), 195-214.

- Ertimur, Y., Ferri, F., & Maber, D. A. (2012). Reputation penalties for poor monitoring of executive pay: Evidence from option backdating. *Journal of Financial Economics*, 104(1), 118-144.
- Faleye, O., Hoitash, R., & Hoitash, U. (2011). The costs of intense board monitoring. *Journal of Financial Economics*, 101(1), 160-181.
- Faleye, O., Hoitash, R. & Hoitash, U. (2013) Industry expertise on corporate boards. *Northeastern U. D'Amore-McKim School of Business Research Paper No. 2013-04. Available at SSRN, <http://ssrn.com/abstract=2117104>.*
- Fanto, J. (1998). The role of corporate law in the adaptation of French enterprises. *Columbia Business Law Review*, 1, 97-120.
- Fee, E., Hadlock, C. & Pierce, J. (2013). Managers with and without Style: Evidence using exogenous variation. *The Review of Financial Studies*, 26(3), 567-601.
- Fich, E. M. (2005). Are some outside directors better than others? Evidence from director appointments by Fortune 1000 firms. *The Journal of Business*, 78(5), 1943-1972.
- Fich, E. M., & Shivdasani, A. (2007). Financial fraud, director reputation, and shareholder wealth. *Journal of Financial Economics*, 86(2), 306-336.
- Flabbi, L., Macis, M., Moro, A. & Shivardi, F. (2013). Do female executives make a difference? The impact of female leadership on firm performance and gender gaps in wages. *Unpublished Working Paper*.
- Fracassi, C., & Tate, G. A. (2012). External networking and internal firm governance. *Journal of Finance*, 67(1), 153-194.
- Graham, J. R., Li, S., & Qiu, J. (2008). Corporate misreporting and bank loan contracting. *Journal of Financial Economics*, 89(1), 44-61.
- Guimaraes, P., & Portugal, P. (2010). A simple feasible procedure to fit models with high-dimensional fixed effects. *Stata Journal*, 10(4), 628.
- Hermalin, B. E., & Weisbach, M. S. (1998). Endogenously chosen boards of directors and their monitoring of the CEO. *American Economic Review*, 88(1), 96-118.
- Hwang, B. H., & Kim, S. (2009). It pays to have friends. *Journal of Financial Economics*, 93(1), 138-158.
- Jensen, M. C., & Meckling, W. H. (1976). Agency costs and the theory of the firm. *Journal of Financial Economics*, 3(4), 305-360.

- Knyazeva, A., Knyazeva, D., & Masulis, R. W. (2013). The supply of corporate directors and board independence. *Review of Financial Studies*, 26(6), 1561-1605.
- Kramarz, F., & Thesmar, D. (2013). Social networks in the boardroom. *Journal of the European Economic Association*, 11(4), 780-807.
- Lele P. & Siems M. (2007). Shareholder protection: A leximetric approach. *Journal of Corporate Law Studies*, 17, 17-50.
- Linck, J. S., Netter, J. M., & Yang, T. (2009). The effects and unintended consequences of the Sarbanes-Oxley Act on the supply and demand for directors. *Review of Financial Studies*, 22(8), 3287-3328.
- Mace, M. (1986). *Directors: Myth and Reality*. Harvard Business School Press, Boston, MA.
- Martynova, M. & Renneboog, L. (2010). A corporate governance index: Convergence and diversity of national corporate governance regulations. Discussion Paper 2010-17, *Tilburg University, Center for Economic Research*.
- Masulis, R. W., & Mobbs, S. (2011). Are all inside directors the same? Evidence from the external directorship market. *The Journal of Finance*, 66(3), 823-872.
- Masulis, R. W., & Mobbs, S. (2014). Independent director incentives: Where do talented directors spend their limited time and energy? *Journal of Financial Economics*, 111(2), 406-429.
- Mihaly, K., McCaffrey, D. F., Lockwood, J. R., & Sass, T. R. (2010). Centering and reference groups for estimates of fixed effects: Modifications to `felsdsvreg`. *Stata Journal*, 10(1), 82.
- Minow, N. (2008). "Hearing on the bankruptcy of Lehman Brothers", Committee on Oversight and Government Reform, October 6.
- Minton, B., Taillard, J., & Williamson, R. (2011). Do independence and financial expertise of the board matter for risk taking and performance? *Unpublished Working Paper*. Available at SSRN, <http://papers.ssrn.com/abstract=1787126>.
- Nguyen, B. D. (2012). Does the Rolodex matter? Corporate elite's small world and the effectiveness of boards of directors. *Management Science*, 58(2), 236-252.
- Nguyen, B. D. & Nielsen K. M. (2010). The value of independent directors: Evidence from sudden death. *Journal of Financial Economics*, 98(3), 550-67
- Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, 22(1), 435-480.

- Raheja, C. (2005). Determinants of board size and composition: a theory of corporate boards. *Journal of Financial and Quantitative Analysis*, 40, 283–306.
- Reeb, D. M., & Zhao, W. (2013). Director capital and corporate disclosure quality. *Journal of Accounting and Public Policy*, 32(4), 191-212.
- Richardson, S., Tuna, A., & Wysocki, P. D. (2003). Accounting for taste: Board member preferences and corporate policy choices. *Unpublished Working Paper*.
- Rosenstein, S., & Wyatt, J. G. (1990). Outside directors, board independence, and shareholder wealth. *Journal of financial economics*, 26(2), 175-191.
- Rosenstein, S., & Wyatt, J. G. (1997). Inside directors, board effectiveness, and shareholder wealth. *Journal of financial Economics*, 44(2), 229-250.
- Schmidt, B. (2014). Costs and benefits of 'friendly' boards during mergers and acquisitions. In *EFA 2009 Bergen Meetings Paper*. Available at SSRN, <http://papers.ssrn.com/abstract=1219102>.
- Shivdasani, A., & Yermack, D. (1999). CEO involvement in the selection of new board members: An empirical analysis. *The Journal of Finance*, 54(5), 1829-1853.
- Wang, C., Xie, F., & Zhu, M. (2013). Industry expertise of independent directors and board monitoring. *Journal of Financial and Quantitative Analysis*, forthcoming.
- Warther, V. A. (1998). Board effectiveness and board dissent: A model of the board's relationship to management and shareholders. *Journal of Corporate Finance*, 4(1), 53-70.
- Westphal, J. D. (1999). Collaboration in the boardroom: Behavioral and performance consequences of CEO-board social ties. *Academy of Management Journal*, 42(1), 7-24.
- White, J. T., Woidtke, T., Black, H. A., & Schweitzer, R. L. (2013). Appointments of academic directors. *Journal of Corporate Finance*, forthcoming.
- Wintoki, M. B., Linck, J. S., & Netter, J. M. (2012). Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics*, 105(3), 581-606.
- Withers, M. C., Hillman, A. J., & Cannella, A. A. (2012). A multidisciplinary review of the director selection literature. *Journal of Management*, 38(1), 243-277.

APPENDIX

1. Variables

Panel A	Director Variables
Directorship	Triplet (director; firm; status)
Woman	Dummy equals to 1 if the director is a female
Foreigner	Dummy equals to 1 if the director is not a French citizen
Age	Director's age in year
Independent	Dummy equals to 1 if the director complies with the AFEP/MEDEF definition (Corporate Governance code) of independent director.
Insider	Dummy equals to 1 if the director is an executive of the firm
Industry expert	Dummy equals to 1 if the director is or has been employed in the same industry as the firm where she sits in (one-digit code)
Industry expert independent	Dummy equals to 1 if the director is independent regarding AFEP/MEDEF criteria and is or has been employed in the same industry as the firm where she sits in (one-digit code)
Financial expert	Dummy equals to 1 if the director is or has been employed in the financial industry
Financial expert independent directors	Dummy equals to 1 if the director is independent regarding AFEP/MEDEF criteria and is or has been employed in the financial industry
Directors connected with other board member(s) through high civil-servant network	Dummy equals to 1 if the director and at least one other director have a civil servant experience
Directors connected with other board member(s) through X-ENA network	Dummy equals to 1 if both the director and at least one other director graduated from ENA or graduated from Ecole Polytechnique
Directors connected with other board member(s) through X-ENA-Business Schools -IEP network	Dummy equals to 1 if both the director and at least one other director share one of these four type of graduation : ENA, Ecole Polytechnique, top business schools (HEC-ESSEC-ESCP), and IEP
Directors connected with CEO through educational network CEONET	Dummy equals to 1 if the director belongs to the CEO network (i.e. they share one of these four types of graduation: ENA, Ecole Polytechnique, IEP, top business schools: HEC-ESSEC-ESCP)
Multi-directorships	Dummy equals to 1 if the director has at least one other directorship over the period in the SBF120 index

Panel B	Board Variables
Board size	Size of the board
% of Independents	Proportion of independent directors, excluding the director of interest (in the regressions only)
% of Insiders	Proportion of inside directors, excluding the director of interest (in the regressions only)
% of Industry Experts	Proportion of industry expert directors, excluding the director of interest (in the regressions only)

% of Industry Expert Independents	Proportion of industry expert independent directors, excluding the director of interest (in the regressions only)
% of Financial Experts	Proportion of financial expert directors, excluding the director of interest (in the regressions only)
% of Financial Expert Independents	Proportion of financial expert independent directors, excluding the director of interest (in the regressions only)
% of Women	Proportion of female directors
% of Foreigners	Proportion of non-French directors
% of Busy Directors	Proportion of directors who have at least one other directorship during the same year in the SBF120 index
% of Young Directors	Proportion of directors who are less than 45 years old
One-Tier Board	Dummy equals to 1 if the board is a one-tier board
Supervisory Board	Dummy equals to 1 if the board is a two-tier board
Chairman/CEO Separation	Dummy equals to 1 if the board is a one-tier board with a separation between the Chief Executive and the Chairman of the board positions

Panel C	Firm Variables
Number of Employees	Number of employees
Leverage	equals to total debt over total equity
R&D investment	equals to the ratio of R&D expenditures over total sales
Stock volatility	equals to the standard deviation of the monthly stock returns over the previous 50 months
Ownership (float)	equals to the share of outstanding shares held by significant owners (defined as owners with 5% or more of the equity capital).
ROA (Return on Assets)	equals to the ratio between EBITDA (Earnings before interest, taxes, depreciation and amortization) and beginning-year total assets
ROE (Return on Equity)	equals to the ratio between net income and total equity

2. Supplementary descriptive statistics

**Table A.1: Descriptive statistics for board variables
(firm-year observations)**

Variables	Obs	Mean	Median	Std.Dev.
Board Size	625	12.11	12	3.48
% of Independent Directors	625	0.49	0.46	0.21
% of Insider Directors	625	0.09	0.08	0.09
% of Industry Expert Directors	625	0.55	0.55	0.22
% of Industry Expert Independent Directors	625	0.19	0.17	0.18
% of Financial Expert Directors	625	0.57	0.58	0.22
% of Financial Expert Independent Directors	625	0.28	0.25	0.16
% of Women	625	0.10	0.09	0.09
% of Foreigner Directors	625	0.22	0.18	0.20
% of Busy Directors	625	0.35	0.36	0.19
% of Young Directors	625	0.19	0.17	0.17
Supervisory Board	625	0.26	0	0.44
Chairman/CEO Separation (one-tier board)	625	0.25	0	0.44

**Table A.2: Descriptive statistics for firm variables
(firm-year observations)**

Variables	Obs	Mean	Median	Std. Dev.
Number of Employees	625	53187	17,948	78436
Leverage	625	0.91	0.67	1.18
R&D Investment	590	0.02	0	0.05
Stock Volatility	598	0.56	0.33	2.50
Ownership (float)	625	0.39	0.41	0.23
ROA	619	0.04	0.04	0.05
ROE	620	0.11	0.11	0.14

3. Selection bias

Our identification strategy necessitates excluding non-connected firms and directors, as well as directors who have a single observation in the sample period. The comparison between connected and unconnected firms shows that for financial variables, disconnected firms do not differ significantly from connected ones. Regarding board composition, unconnected firms have a slightly smaller board with less foreigners, more insiders and less independent directors: the board is dominated by company owners, as well as top executives, explaining firm isolation. There is therefore no major concern for the relevance of our sample regarding

general conclusion. Concerning directors who appear only once in our database, the only apparent selection bias stems from a significant higher proportion of female: indeed, 42% of these ‘unique’ directors have been appointed in our last year (2011). At this moment, the pressure for hiring female director was significantly higher, due to the forthcoming gender quota. This selection bias is more the consequence of a new regulation requirement than an endogeneity issue.

Tests of hypotheses 1 to 5 rely on the estimation of status effects α , and in particular on the estimation of the independent status effect. These parameters are fitted using individuals with a diversity of statuses over our sample period (for instance, independent in two firms and affiliated in a third, or independent for a while in a firm and then affiliated). Out of a total of 1,821 directorships (director-firm-status observations), 497 (27%) fill this condition. These 497 directorships correspond to a total of 174 distinct directors and 1,921 director-firm-year observations. The other directorships are held by directors with the same status whatever the directorship (never independent for 39% and always independents for 34%). The number of directorships, directors and observations used to identify the effect of industry expertise are only slightly lower.

Table A.3: Identification strategy and selection bias

Variables	All directorships (1,821 obs.)		Directorships held by individuals with at least one independent directorship (1,107 obs.)		Independent identifying directorship (497 obs.)		chi2	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Identifying directorship s vs the rest	Identifying dir. vs indep. dir.
Woman	0.12	0.32	0.13	0.33	0.09	0.29	1.22	9.39***
Foreigner	0.22	0.42	0.23	0.42	0.10	0.30	1.07	93.00***
Age	58.25	10.13	60.39	9.11	59.91	9.69		
Financial Expertise	0.56	0.50	0.59	0.49	0.61	0.49	8.5***	1,7
Industry- Expertise	0.53	0.50	0.44	0.50	0.54	0.50	87.19***	34.23***

Note: Chi-square tests (p-values) for equality of distributions between the groups are given. Reading: considering all directorships, 12% are held by women over our sample period. This share is 13% if we consider individuals with an independence status. Finally, the share of female is 9% if we only consider individuals used to identify the coefficient on Independence (that is, individuals with a variation in the independence status).

Table A.3 provides evidence on the possible selection bias produced by our strategy of identification. Among the independent directors, the sub-group of identifying directors has a significant lower proportion of foreigners and women than the sub-group of other independent directors. The main reason is the lower occurrence of multiple directorships for foreigners and female directors: for instance, only 22% of foreign directors have multiple directorships, against 52% for French directors. The geographical distance may partly explain this pattern;

for women, this may reflect their rather marginal role in the traditional French corporate system. These observations suggest that individuals used to identify the independence status coefficient are more involved in this system, with a greater experience of French boards' functioning.

Finally, the structure of our dataset, with a common output for directors sitting the same year in a given company, imposes some restrictions when analyzing individual fixed effects. As previously argued, fixed effects for non-mover directors arriving and leaving at the same dates in the same firm are not accurately estimated. This is actually the case for 683 directorships, out of 1,821; we exclude them when comparing fixed effects distribution across groups. Table A.4 compares individual characteristics and status between directorships with accurate fixed effects (group A) and directorships with non-accurate fixed effects (group B). The share of women as well as the age are not significantly different between the two groups. We see however that the group B includes significantly more foreigners. The share of industry experts is also greater, this being related with a lower proportion of independent directors. Finally, there are substantially less financial experts in the excluded group. Of course, we cannot exclude the possibility of a selection bias in our estimation. But the pattern of this potential bias is far from clear: why would a foreign director with industry expertise be of a lower or higher intrinsic quality than a French one with financial expertise? In addition, the selection plays for the two groups we compare, independent and non-independent directors. We are therefore confident that this selection does not produce a substantial bias when examining the relationship between independence and individual fixed effects. As a way to check the robustness of our results, we also implement our quantile regressions on the full sample (1,821 directorships, part 4, Table A.7).

Table A.4: Director fixed effects and selection bias

Variables	Directorships with accurate fixed effect (1,138)		Excluded directorships (683)		Tests	
	Mean	Std. Dev.	Mean	Std. Dev.	Student test	chi2
Women	0.12	0.32	0.12	0.33	-0.001	0.00
Foreigner	0.18	0.39	0.30	0.46	-0.12***	32.32***
Age	58.36	9.93	57.91	10.48	0.46	
Financial Expert	0.59	0.49	0.51	0.50	0.08***	12.19***
Independent	0.51	0.50	0.43	0.50	0.08***	11.54***
Insider	0.08	0.26	0.08	0.27	-0.01	0.29
Industry Expert	0.51	0.50	0.57	0.50	-0.06*	6.15**
Industry Expert*Independent	0.19	0.39	0.17	0.38	0.02	0.67

Note: Student and Chi-square tests (p-values) for equality of distributions between the two comparison groups are given.

4. Supplementary results

**Table A.5: Independence status and operating performance
(excluding the first year of the directorship)**

Variables	(1) ROE	(2) ROE	(3) ROE	(4) ROE	(5) ROA	(6) ROA	(7) ROA	(8) ROA
Independent	-0.005 (0.005)	-0.011* (0.007)	-0.031*** (0.010)	-0.036*** (0.011)	-0.001 (0.002)	-0.003 (0.002)	-0.009** (0.003)	-0.011*** (0.003)
Insider	0.015 (0.011)	0.010 (0.013)	0.018 (0.014)	0.029* (0.017)	0.005 (0.004)	0.005 (0.004)	0.007 (0.004)	0.009** (0.004)
Industry Expert			-0.014 (0.010)	-0.019 (0.012)			-0.004 (0.003)	-0.007** (0.004)
IndustryExpert* Independent.			0.042*** (0.013)	0.053*** (0.016)			0.012*** (0.004)	0.014*** (0.005)
% of Independents	-0.030 (0.056)	-0.024 (0.069)	-0.214** (0.098)	-0.306*** (0.097)	-0.013 (0.018)	-0.010 (0.021)	-0.047* (0.027)	-0.096*** (0.027)
% of Insiders	0.160 (0.117)	0.217* (0.129)	0.309** (0.143)	0.520*** (0.177)	0.058 (0.045)	0.063 (0.044)	0.081* (0.045)	0.106** (0.045)
% of Industry Experts			-0.113 (0.092)	-0.138 (0.101)			-0.022 (0.027)	-0.068** (0.029)
% of Industry Expert Independents			0.460*** (0.130)	0.653*** (0.141)			0.089** (0.036)	0.148*** (0.039)
Chairman/CEO Separation	0.013 (0.015)	0.013 (0.016)	0.014 (0.016)	0.004 (0.021)	0.003 (0.004)	0.003 (0.004)	0.003 (0.004)	0.000 (0.004)
Supervisory Board	-0.001 (0.043)	0.013 (0.043)	0.017 (0.043)	-0.010 (0.038)	-0.003 (0.014)	-0.001 (0.014)	0.001 (0.014)	-0.001 (0.011)
Board Size	0.003 (0.004)	0.003 (0.004)	0.003 (0.004)	0.006 (0.004)	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)	0.003** (0.001)
% of Women	-0.161* (0.089)	-0.162* (0.096)	-0.131 (0.097)	-0.165 (0.111)	-0.042 (0.027)	-0.038 (0.029)	-0.033 (0.029)	-0.038 (0.032)
% of Foreigners	0.026 (0.098)	0.012 (0.108)	-0.043 (0.103)	-0.114 (0.100)	-0.032 (0.031)	-0.042 (0.032)	-0.053* (0.032)	-0.068*** (0.026)
% of Busy Directors	0.037 (0.048)	0.062 (0.052)	0.055 (0.053)	0.074 (0.061)	0.014 (0.015)	0.017 (0.015)	0.015 (0.016)	0.028 (0.018)
% of Young Directors	-0.161*** (0.057)	-0.160*** (0.059)	-0.153*** (0.058)	-0.202*** (0.072)	-0.041** (0.016)	-0.038** (0.018)	-0.036** (0.017)	-0.050** (0.020)
Number of Employees (in log)	0.012 (0.026)	0.010 (0.027)	0.019 (0.027)	0.010 (0.030)	0.003 (0.007)	0.003 (0.008)	0.005 (0.008)	-0.000 (0.009)
Leverage	-0.041 (0.032)	-0.040 (0.037)	-0.040 (0.036)	-0.004 (0.041)	-0.007** (0.003)	-0.007** (0.003)	-0.007** (0.003)	-0.006* (0.003)
R&D on Sales	-0.659*** (0.206)	-0.622*** (0.212)	-0.634*** (0.212)	-0.657 (0.531)	-0.271** (0.116)	-0.260** (0.125)	-0.262** (0.127)	-0.324** (0.143)
Stock Volatility	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	-0.002 (0.002)	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)	0.001 (0.001)
Ownership	-0.086 (0.068)	-0.090 (0.072)	-0.064 (0.069)	0.004 (0.080)	0.012 (0.022)	0.008 (0.022)	0.013 (0.023)	0.015 (0.021)
Observations	6,280	6,280	6,280	2,420	6,265	6,265	6,265	2,414
Nb of firms	612	612	612	574	611	611	611	574
R2-adj	0.506	0.445	0.461	0,506	0.661	0.623	0.628	0,707

Director fixed effect	No	Yes	Yes	No	No	Yes	Yes	No
Director-Year fixed effect	No	No	No	Yes	No	No	No	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	No	Yes	Yes	Yes	No

Notes: (1) Dependent variable: Return On Equity (columns 1 to 4) or Return On Assets (columns 5 to 8). (2) Directors' controls include: the statuses (independent, insider, industry specific expert) and the interaction term (industry expert*independent) (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 45, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board) and a dummy that takes value 1 in case of separation between CEO and chairman positions in a one tier board (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) Column 1 includes firm and year fixed effects. Columns 2 and 3 include director, firm and year fixed effects. Column 4 includes firm and director-year fixed effects. (6) Robust standard errors, clustered on firm by years, in parentheses. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1.

**Table A.6: Independence status and operating performance
(excluding directorships of less than three years)**

Variables	(1) ROE	(2) ROE	(3) ROE	(4) ROE	(5) ROA	(6) ROA	(7) ROA	(8) ROA
Independent	0.003 (0.004)	-0.007 (0.006)	-0.028*** (0.010)	-0.024** (0.011)	-0.000 (0.002)	-0.003 (0.002)	-0.008* (0.004)	-0.006* (0.003)
Insider	0.010 (0.011)	0.013 (0.012)	0.019 (0.013)	0.028* (0.016)	0.003 (0.005)	0.004 (0.005)	0.005 (0.005)	0.008** (0.004)
Industry Expert			-0.020** (0.010)	-0.012 (0.011)			-0.004 (0.004)	-0.003 (0.003)
IndustryExpert*Independent.			0.042*** (0.013)	0.047*** (0.014)			0.011* (0.006)	0.009** (0.004)
% of Independents	0.043 (0.050)	0.046 (0.057)	-0.140* (0.079)	-0.261*** (0.094)	-0.002 (0.019)	-0.006 (0.021)	-0.052* (0.027)	-0.082*** (0.026)
% of Insiders	0.099 (0.119)	0.084 (0.128)	0.160 (0.139)	0.451** (0.182)	0.029 (0.053)	0.014 (0.052)	0.031 (0.054)	0.098** (0.046)
% of Industry Experts			-0.135* (0.079)	-0.163 (0.100)			-0.029 (0.027)	-0.069*** (0.027)
% of Industry Expert Independents			0.416*** (0.106)	0.639*** (0.124)			0.106*** (0.037)	0.152*** (0.034)
Chairman/CEO Separation	0.014 (0.014)	0.013 (0.014)	0.012 (0.014)	0.007 (0.021)	0.003 (0.005)	0.003 (0.004)	0.002 (0.004)	0.001 (0.004)
Supervisory Board	0.031 (0.040)	0.033 (0.041)	0.026 (0.041)	0.040 (0.038)	-0.002 (0.015)	-0.002 (0.015)	-0.004 (0.015)	0.007 (0.011)
Board Size	0.001 (0.003)	0.001 (0.003)	0.001 (0.003)	0.004 (0.004)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.002* (0.001)
% of Women	-0.095 (0.076)	-0.110 (0.081)	-0.085 (0.080)	-0.209* (0.106)	-0.036 (0.028)	-0.038 (0.030)	-0.031 (0.030)	-0.052* (0.028)
% of Foreigners	-0.126 (0.087)	-0.146 (0.090)	-0.183** (0.088)	-0.091 (0.101)	-0.033 (0.032)	-0.037 (0.033)	-0.049 (0.032)	-0.045* (0.024)
% of Busy Directors	0.019 (0.046)	0.031 (0.048)	0.025 (0.048)	0.047 (0.057)	0.015 (0.013)	0.017 (0.014)	0.016 (0.014)	0.024 (0.016)
% of Young Directors	-0.123** (0.052)	-0.131** (0.055)	-0.147*** (0.055)	-0.206*** (0.071)	-0.025 (0.017)	-0.022 (0.018)	-0.026 (0.017)	-0.047** (0.020)
Number of Employees (in log)	0.023 (0.021)	0.021 (0.022)	0.031 (0.021)	0.019 (0.031)	0.010 (0.007)	0.009 (0.007)	0.012* (0.007)	0.002 (0.009)
Leverage	-0.021 (0.014)	-0.021 (0.015)	-0.024 (0.015)	-0.006 (0.037)	-0.011*** (0.003)	-0.011*** (0.004)	-0.012*** (0.004)	-0.007** (0.003)
R&D on Sales	-0.442** (0.175)	-0.433** (0.183)	-0.476** (0.193)	-0.523 (0.370)	-0.204** (0.104)	-0.197* (0.109)	-0.208* (0.112)	-0.253** (0.100)
Stock Volatility	0.003** (0.001)	0.003** (0.001)	0.003** (0.001)	-0.002* (0.001)	0.001* (0.000)	0.001* (0.000)	0.001* (0.000)	0.000 (0.000)
Ownership	-0.059 (0.064)	-0.061 (0.068)	-0.047 (0.066)	-0.046 (0.074)	0.016 (0.024)	0.014 (0.025)	0.018 (0.025)	0.005 (0.020)
Observations	5,778	5,778	5,778	2,139	5,769	5,769	5,769	2,138
Nb of firms	540	540	540	562	540	540	540	562
R2-adj	0.544	0.483	0.501	0,513	0.681	0.635	0.642	0,723
Director fixed effect	No	Yes	Yes	No	No	Yes	Yes	No
Director-Year fixed effect	No	No	No	Yes	No	No	No	Yes
Firm and Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Dependent variable: Return On Equity (columns 1 to 4) or Return On Assets (columns 5 to 8). (2) Directors' controls include: the statuses (independent, insider, industry specific expert) and the interaction term (industry expert*independent) (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 45, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board) and a dummy that takes value 1 in case of separation between CEO and chairman positions in a one tier board (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) Column 1 includes firm and year fixed effects. Columns 2 and 3 include director, firm and year fixed effects. Column 4 includes firm and director-year fixed effects. (6) Robust standard errors, clustered on firm by years, in parentheses. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table A.7: Director fixed effects and independence (quantile regressions on all directorships)

Panel A: ROE

Variables	(1) 10th	(2) 20th	(3) 30th	(4) 40th	(5) 50th	(6) 60th	(7) 70th	(8) 80th	(9) 90th
Independent	0.014*** (0.002)	0.012*** (0.001)	0.010*** (0.001)	0.009*** (0.001)	0.009*** (0.001)	0.010*** (0.001)	0.009*** (0.001)	0.008*** (0.001)	0.008*** (0.002)
Insider	0.016*** (0.003)	0.012*** (0.002)	0.008*** (0.002)	0.008*** (0.002)	0.008*** (0.002)	0.009*** (0.002)	0.009*** (0.002)	0.010*** (0.003)	0.010*** (0.003)
Industry Expert	0.002 (0.002)	0.002 (0.002)	0.002 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.003** (0.001)	-0.002 (0.002)
Woman	-0.007*** (0.002)	-0.004* (0.002)	-0.001 (0.002)	0.000 (0.001)	0.000 (0.001)	0.001 (0.002)	0.003 (0.003)	0.009** (0.004)	0.010*** (0.004)
Foreigner	0.001 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.002)
Age	0.006 (0.009)	0.012* (0.007)	0.001 (0.005)	0.001 (0.004)	-0.000 (0.003)	-0.003 (0.004)	-0.005 (0.005)	-0.008 (0.006)	-0.001 (0.008)
Financial Expert	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.003** (0.001)	-0.002 (0.001)
Multi-directorships	-0.000 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.002)	0.001 (0.002)
Observations	1,802	1,802	1,802	1,802	1,802	1,802	1,802	1,802	1,802
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: ROA

Variables	(1) 10th	(2) 20th	(3) 30th	(4) 40th	(5) 50th	(6) 60th	(7) 70th	(8) 80th	(9) 90th
Independent	0.004*** (0.001)	0.004*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.001)	0.003*** (0.001)
Insider	0.002* (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.001** (0.001)	0.001** (0.001)	0.001** (0.001)	0.001** (0.001)	0.001 (0.001)	0.002 (0.001)
Industry Expert	0.000 (0.001)	0.001 (0.001)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001* (0.001)	-0.001* (0.001)
Woman	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.000)	-0.000 (0.000)	0.001 (0.001)	0.002 (0.001)	0.004*** (0.001)
Foreigner	0.001 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.001** (0.000)	0.001** (0.001)	0.000 (0.001)
Age	0.001 (0.003)	0.002 (0.002)	0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)	-0.001 (0.002)	-0.002 (0.002)	-0.003 (0.003)
Financial Expert	0.001 (0.001)	0.001 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001 (0.000)	-0.001 (0.000)
Multi-directorships	0.000 (0.001)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.001** (0.001)
Observations	1,796	1,796	1,796	1,796	1,796	1,796	1,796	1,796	1,796
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Dependent variable: Director fixed effect computed with Return On Equity value (Panel A) or Return On Assets (Panel B). (2) Director controls include: the statuses (independent, insider, industry expert, financial expert), the age, the gender and foreigner dummies as well as a dummy for multi-directorships (3) All models include firm fixed effects. (4) Robust standard errors in parentheses. (5) Significance: *** p<0.01, ** p<0.05, * p<0.1.